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THE JOURNAL OF
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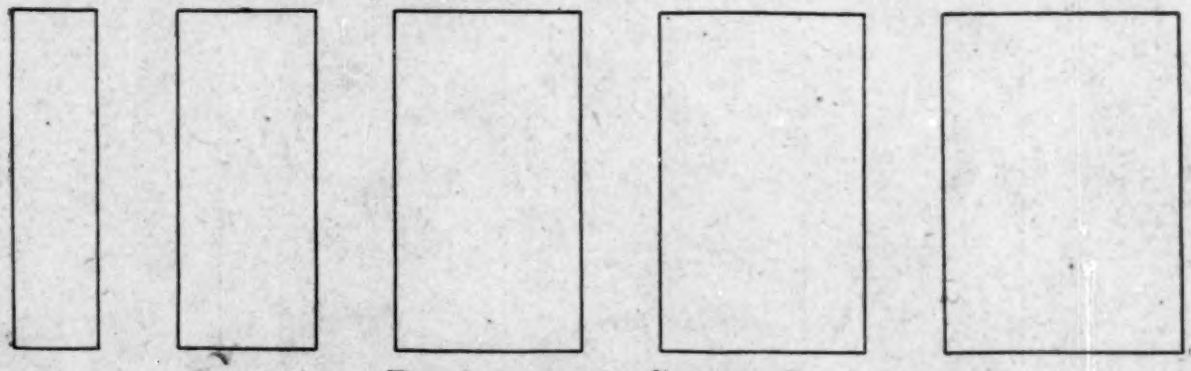
TESTS OF ESTHETIC APPRECIATION

EDWARD L. THORNDIKE
Teachers College, Columbia University

It is desirable to have means for measuring esthetic appreciation with a wide range of content, both for theoretical studies of its nature and correlations, and for such practical purposes as tests of instruction or vocational guidance. One of the most convenient means for such measurements is a graded series of known degrees of esthetic merit to be arranged in order, the person's ability being measured inversely by the sum of his deviations from the correct order. Some such graded series are presented here, together with what is known of the relative esthetic merit of each specimen in each series.

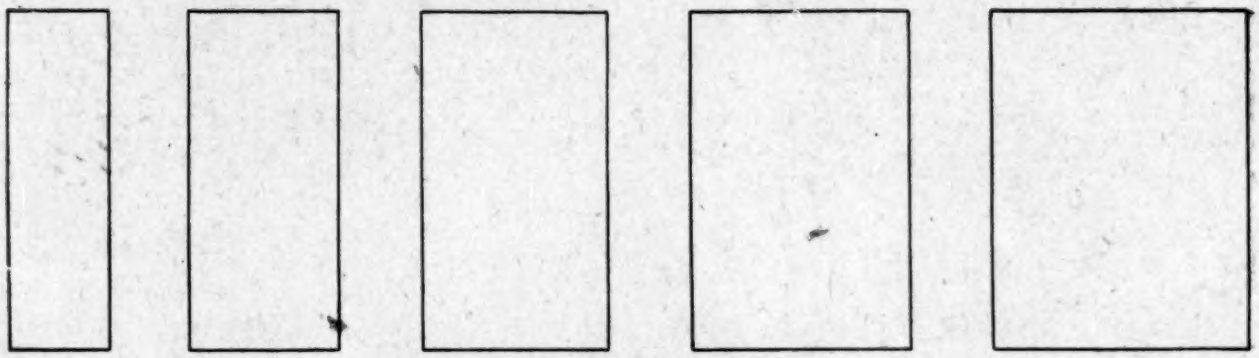
The contents of the series are not specially good for the purpose, their use for tests of esthetic judgment having been a secondary consideration. The series will be useful, however, until enough better ones are constructed.



RECTANGLES: SERIES I.

Calling the rectangles in order from left to right 1, 2, 3, 4, 5, the correct order by the consensus is 3, 4, 2, 5, 1. Of 200 judges, college juniors,

58½%	rated	3	as	better	looking	than	4
59 %	"	4	"	"	"	"	2
69 %	"	2	"	"	"	"	5
62 %	"	5	"	"	"	"	1



RECTANGLES: SERIES II.

Calling the rectangles in order from left to right 1, 2, 3, 4 and 5, the correct order by the consensus is 3, 2, 4, 1, 5. Of the 200 judges,

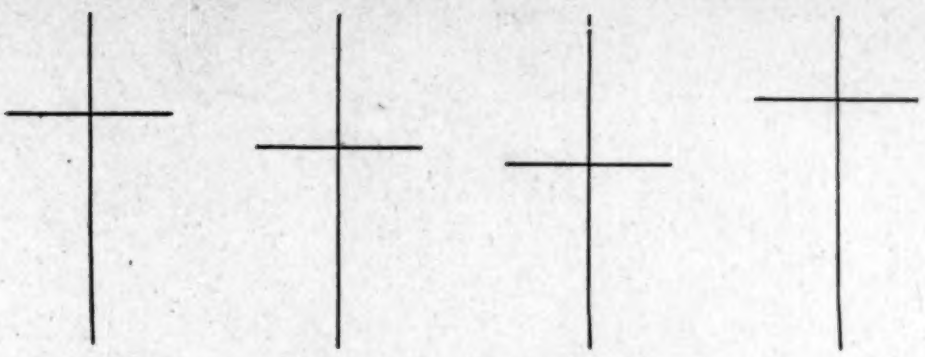
60 % rated 3 as better looking than 2
66½% " 2 " " " " 4
63½% " 4 " " " " 1
65 % " 1 " " " " 5

It may be noted that the 200 judges rated No. 4 of Series I and No. 2 of Series II as equally good looking, 47½% to 52½%. So also for No. 2 of Series I and No. 4 of Series II (51% to 49%), for No. 5 of Series I and No. 1 of Series II, (51% to 49%), and for No. 1 of Series I and No. 5 of Series II (51½% to 48½%).

CROSSES: SERIES III.

Calling the crosses in order from left to right 1, 2, 3 and 4, the correct order by the consensus is 3, 2, 4, 1. Of 100 college students,

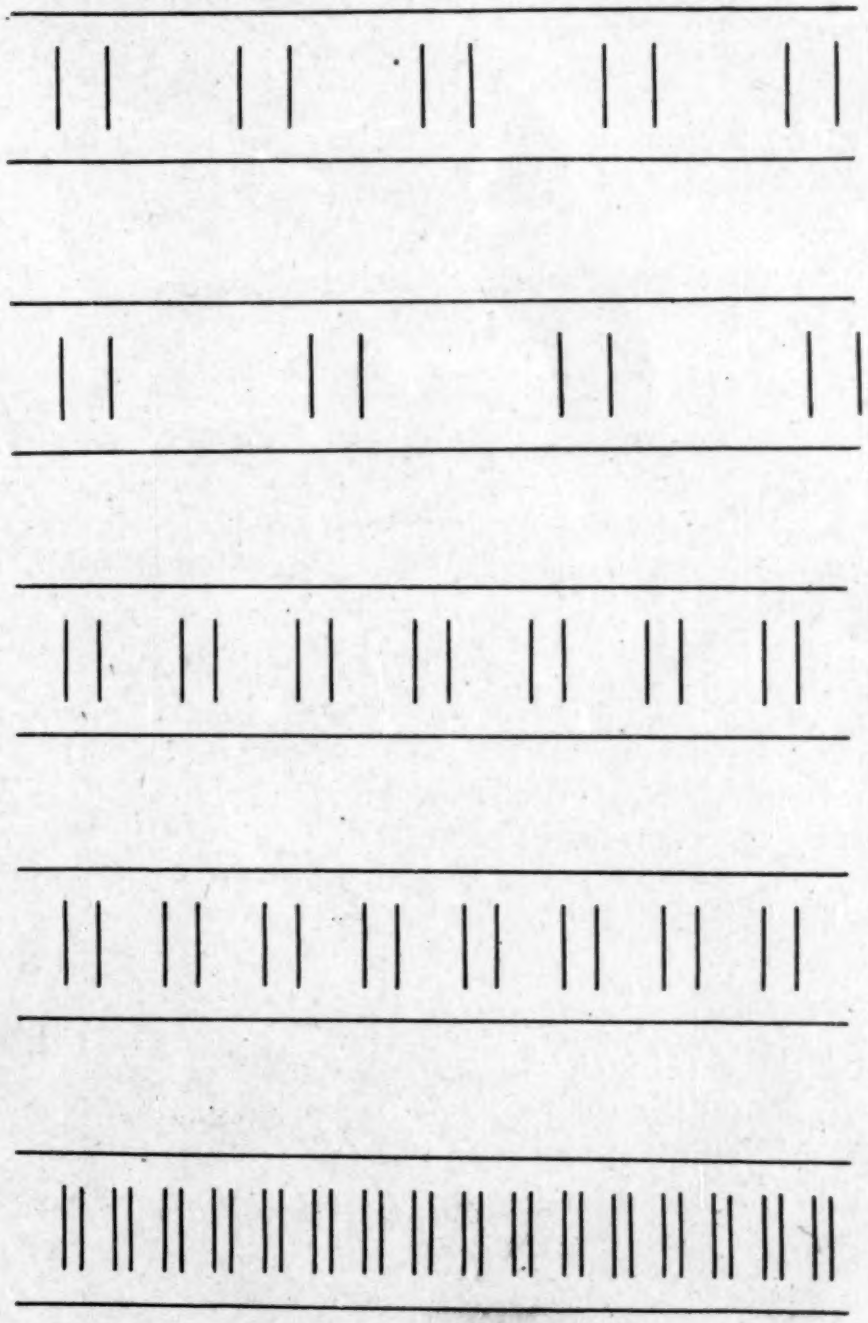
78% rated 3 as better looking than 2
72% " 2 " " " " 4
75% " 4 " " " " 1



CROSSES: SERIES IV.

Calling the crosses in order from left to right 1, 2, 3 and 4, the correct order by the consensus is 4, 1, 2, 3. Of 100 college students,

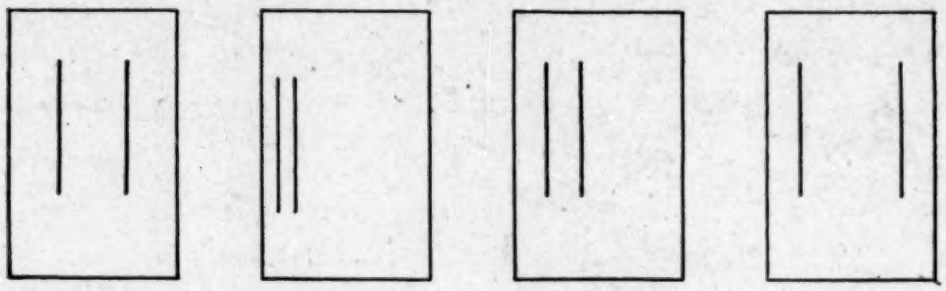
69% rated 4 as better looking than 1
76% " 1 " " " " 2
82% " 2 " " " " 3



DESIGNS: SERIES V.

Calling the designs in order from top to bottom 1, 2, 3, 4 and 5, thecorrect order by the consensus is 3, 4, 1, 2, 5. Of 200 college students,

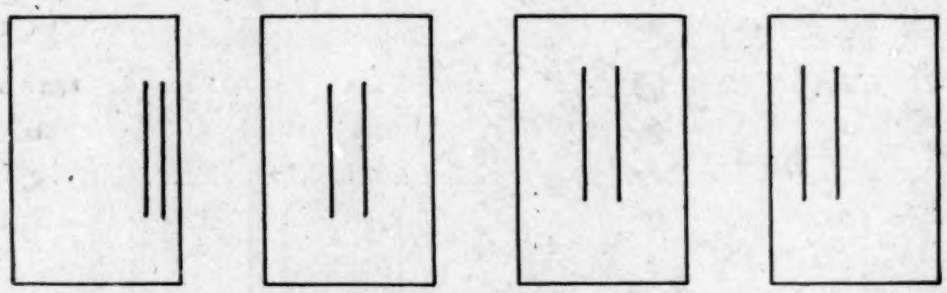
62½% rated 3 as better looking than 4
73 % " 4 " " " " 1
72 % " 1 " " " " 2
67½% " 2 " " " " 5



DESIGNS: SERIES VI.

Calling the designs in order from left to right 1, 2, 3 and 4, the correct order by the consensus is 1, 4, 3, 2. Of 200 college students,

66% rated 1 as better looking than 4
74% " 4 " " " " 3
73% " 3 " " " " 2



DESIGNS: SERIES VII.

Calling the designs in order from left to right 1, 2, 3, 4, the correct order by the consensus is 2, 3, 4, 1. Of 200 college students,

63% rated 2 as better looking than 3
73% " 3 " " " " 4
69% " 4 " " " " 1

In using these tests the instructions may be simply for each series: "Examine these rectangles (crosses, designs). Mark the one which you think is the best looking 1; mark the one which you think is the next best looking 2, and so on for 3 and 4 (3, 4 and 5)."

In scoring the results, the simple method of counting the sum of displacements from the correct order will be adequate for most of the purposes for which the tests will be used.

For a more exact scoring, the entire experiment may be treated as if it were a series of comparisons of pairs and the results evaluated as in a regular "right and wrong cases" experiment. The tests are, however, not extensive enough for convenient treatment by this method.

Appreciation of the Quality of a Line of Poetry Written to Complete a Couplet, the First Line Being Given

The test consists in ranking in order of merit seven or more lines, each a completion of the same first line as in the specimen case shown below.

First Line: *But still he only saw and did not share.*
Completions:
He could not tell us what he did there.
Tho longing to join, he did not dare.
He merely felt, but did not care.
He feared his virgin deed to do and dare.
The others pleasure, nor did he care.
His saddened heart, still wand'ring, was not there.
Her varied toil, her deep and heavy care.
The fun and frolic of the village fair.

The sets of lines to be ranked are either 7 or 13 in number. The sets of thirteen duplicate the sets of seven, plus six interspaced degrees of merit, and need be used only for very good judges who rank the more widely spaced sets perfectly, or nearly so.

The sets are so chosen that the differences in merit are roughly equal in so far as the opinions of thirty persons of general education can be accepted as giving just measures of the merit of a line of poetry. If the test in general proves useful, lines with exactly equal steps of difference in merit can be provided by having many lines written and ranked by judges whose competence is beyond dispute.

The present sets were obtained and graded as follows:

Sixty adults wrote lines to complete certain given lines. Thirty persons of general education and cultivation rated all the sixty completions for a given line, in general calling the worst six 1, the next worst six, 2, and so on. They did not use the grades 1 to 10 absolutely for successive sixes, however, but were free to make their division 5, 7, 6, 6, 4, 8, or other approximations to 6. The

sum of the grades given by the thirty to each line was obtained. Lines were chosen to make sets whose sums of grades differed successively by approximately 30. These form the sets of seven lines. Interspersed lines were chosen whose sums of grades were such as to make the successive differences approximately 15. The number of judges out of thirty whose rankings put each line above, equal to, and below its neighbor in the set of seven, was then determined for each set of seven.

It appears that the differences of the sets are a trifle smaller as we pass from poorer to better lines. But the discrepancies are very slight and may be disregarded until sets selected on the basis of rankings by experts are available.

The sets to be used as tests are given below, each arranged in a random order, just as they should be given in practice. Keys showing the presumably correct order are given in Table I, which contains also the facts concerning the sums of grades and judgments of better, equal and worse obtained from the thirty judges.

The keys include the facts for some extra lines which are given below. These lines will not be used in tests of judgment but may be of service when the sets are used as rough provisional scales to score the quality of lines written to complete couplets.

A, First line—But still he only saw and did not share.

AI primary

A 3—His saddened heart still wand'ring was not there.
12—Though longing to join her did not dare.
13—He could not tell us what he did there.
31—He feared his virgin deed to do and dare.
37—Her varied toil, her deep and heavy care.
44—He merely felt, but did not care.
49—The other's pleasure, nor did he care.

AI interspaced

A 8—The life about him, the atmosphere.
16—To see is not to share, else love were fair.
27—For his own thoughts engrossed his every care.
28—To take the joy of life he did not dare.
42—Was he sorry? No, he did not care.
60—The apparent consternation of the bear.

AII primary

A 1—And action ever complements the dare.
22—The joys which youth alone can see.
25—And, damned of seeing, was of comfort bare.
35—For all the world to him was but a snare.
37—Her varied toil, her deep and heavy care.
47—In him the action brought forth no response.
56—Devoutly tall, divinely short, discreetly rare.

AII interspaced

A 4—His crime is only that he loved the fair.
8—The life about him, the atmosphere.
27—For his own thoughts engrossed his every care.
28—To take the joy of life he did not dare.
36—For he did not wish to partake of another's care.
41—A passing thought, for yet he did not care.

AIII primary

A 5—The horrors rampant there.
11—The opportunities which are so rare.
33—The happiness that he had gathered there.
37—Her varied toil, her deep and heavy care.
39—Her beauty, her charm, her glare.
54—"There ain't no core," she said, "to this here pear."
59—The beauteous rag of bone and hank of hair.

AIII interspaced

A 6—There yet was time to save them both, by prayer.
21—For secrets his he could not bear.
26—I'm sure, Sir, 'twas not he who ate the pear.
27—For his own thoughts engrossed his every care.
34—The laughter of the crowds—the noise and life.
40—He only stood and watched with vacant stare.

B, First line—What she has done no tears can wash away.

BI

B 3—The memory of her deeds will ne'er decay.
6—What she has done nothing can make her forget.
12—Who now do weep did not her footsteps stay.
28—Men oft are strong, but passions sway.
37—No grief efface the evil of that day.
41—Nor penitence atone for, however deep.
54—Nor can the forces of the earth repay.

BI interspaced

B23—No hands can soothe, no mother's kiss can sway.
24—The debt she owes, no wealth can e'er repay.
43—But we must all forgive and let her stay.
47—No anguish alter and no prayers make new.
55—Nor any day bring back her quiet face.
57—I'll never forget this dreadful day.

BII

B 2—She thinks it can, so Monday's washing day.
3—The memory of her deeds will ne'er decay.
4—Nor can he afford to stay.
10—Pain, grief and sorrow follow without delay.
18—Nor tears nor prayers, though she prayed for aye.
37—No grief efface the evil of that day.
48—For memories of past will forevermore hold away.

BII interspaced

B 8—For she has marked an immortal clay.
22—The heart she hurt can never be made gay.
27—As for the future, no one can say.
40—We carve in marble, we do not mold in clay.
51—What she has said she never can unsay.
58—Remorse is in vain, 'twill not undo the day.

BIII

B31—No words impassioned can his curses stay.
33—No pow'r can change the errors of a day.
47—No anguish alter, and no prayers make new.
49—Deeply imprinted, it will forever stay.
55—Nor any day bring back her quiet face.
57—I'll never forget this dreadful day.
60—No grief can cleanse the soul, when men betray.

BIII interspaced

B 1—No atonement can ever repay.
5—Bitter memories enclosed the day.
12—Who now do weep, did not her footsteps stay.
17—A life of penance? Yes, perchance it may.
46—No penitence wipe out, no words unsay.
54—Nor can the forces of the earth repay.

BIV

B 9—For sins, like monarchs, hold their sway.
27—As for the future, no one can say.
29—She can but wait and watch and listen and obey.
34—For night is night and day is day.
36—No grief undo, no penitence allay.
46—No penitence wipe out, no words unsay.
58—Remorse is in vain, 'twill not undo the day.

BIV interspaced

B 2—She thinks it can, so Monday's washing day.
13—Remorse her portion from day to day.
18—Nor tears nor prayers, though she prayed for aye.
37—No grief efface the evil of that day.
39—So cease repining and hope for a better day.
56—Nor constant moaning can her pain allay.

C, First line—Old scenes of glory, times long cast behind.

CI

C18—Old hates and feuds the memory can't find.
31—As once ago we form in line.
41—Bring in the wake a sadness well defined.
46—Came floating back on gusts of wind.
47—This happy Christmas season brings again to mind.
56—Old thoughts of love thus clearly brought to mind.
59—The newer story brings them back to mind.

CI interspaced

C 5—Still in the book of memory we find.
25—Are pictured here and there and in the mind.
27—Cast, as it were, a halo round the mind.
40—Await to tell the story and posterity remind.
42—Ever appear most lovely to the mind.
57—His soul still yearns for, to prove again his power.

CII

C 7—Come trooping to us to cheer the weary mind.
10—Return to sight and joyful make the mind.
19—Come back to view, as if of present time.
22—Flit constantly before the eyes of my mind.
34—And staged a show of different kind.
47—This happy Christmas season brings again to mind.
55—Return and with new challenge thrill the mind.

CII interspaced

C 4—Rise fresh into the memory once dim.
35—May now raise prospects in each noble mind.
49—Those strains of music now bring to our mind.
54—Are ever yet the solace of the poor, but hopeful, blind.
57—His soul still yearns for, to prove again his power.
60—Arise and make the present seem unkind.

CIII

C 4—Rise fresh into the memory once dim.
8—Appear once more and calm my wand'ring mind.
13—Unfurled with battle flag and brought to mind.
21—Portray their pictures in the canvass of our minds.
45—Came from the hazy past slowly o'er his mind.
53—In rapid course passed through his fevered mind.
57—His soul still yearns for, to prove again his power.

CIII interspaced

C 9—Comrades unforgotten, pass before the mind.
15—Passed like magic through his mind.
20—Oft come to memory, pure, as though refined.
37—Come again to bind, once more around us wind.
38—Rise up, the sluggish heart to stir once more.
52—Come with that martial music to my mind.

D, First line—Kind self-conceit to some her glass applies.

DI

D 6—And makes them ever noble to their eyes.
9—To others not a glance she ever gives.
12—To those who appear before others' eyes.
22—But to others all her comfort she denies.
31—Their smiling face with gladsome heart replies.
43—Not as to those who would be wise.
52—Shows them their faults and opens wide their eyes.

DI interspaced

D21—And hides for them those faults that others see.
32—And then is shocked by the vision of her eyes.
33—Uncaring if she reveal truth or lies.
39—For here find for whom the lad accries.
48—And then they lead the world in their own eyes.
60—And lo! their stature greatly multiplies.

DII

D19—A potion sometimes of too great size.
23—But appears the same to no one else's eyes.
31—Their smiling face with gladsome heart replies.
34—That truth and reality may appear.
35—To others vain regret and patience tries.
38—Causing many mortals to believe her lies.
42—With roguish laugh and mischief in her eyes.

DII interspaced

D 1—But to most men this event she denies.
8—Smiles over wrinkles and applauds the dyes.
11—And covers o'er a host of short comings.
28—And fools the few who laugh at all replies.
36—And what is large is little to her assisted eyes.
40—And views the fair result with charmed eyes.

DIII

D14—Which so many of her friends despise.
27—But if repressed from others swiftly flies.
33—Uncaring if she reveal truths or lies.
37—And in mercy their wants supply.
45—And all their little glories magnifies.
48—And then they lead the world in their own eyes.
57—Who view themselves with smiling dreaming eyes.

DIII interspaced

D 5—And then behold without disguise.
9—To others not a glance she ever gives.
16—And with a rosy color shows their lives.
22—But to others all her comfort she denies.
31—Their smiling face with gladsome heart replies.
55—And sees them colored by what shades her eyes.

E. First line—As clocks to weight their nimble motion owe.

EI

E 8—So married men to make ends meet must go.
17—Their balance to the pendulum we show.
20—And streams to quick descents their swifter flow.
23—So the wind will ever blow.
29—So culture to solid grind is founded.
41—We on our interest much dependence show.
44—So heavy spirits make the mind to go.

EI interspaced

E 1—One should in life avoid no toil or woe.
13—So much to pendulums that make them so.
15—So many a handsome fellow a sand-bag has laid low.
28—We by ideals our own growth must show.
40—So we by thought around the word must go.
50—So learning to philosophy must bow.

EII

E 2—So from our souls do prompted actions flow.
12—So we, our rapid progress, to the strength of those who row.
14—So we to Life owe ours.
21—Because of burdens men the steadier go.
37—Ships on the sea by some power go.
44—So heavy spirits make the mind to go.
49—Perhaps we too by faults may faster grow.

EII interspaced

E 6—Their use to balanced motion to and fro.
10—Their power to shapeless mass that hidden lies below.
11—Mortals, ambition laden, come and go.
19—So time moves on at rapid gait or slow.
26—So mental ballast helps the thoughts to flow.
57—So we for joy to others' sorrow go.

F, First line—The forests dance, the rivers upward rise.

FI

F18—Reaching, it seems, to Paradise.
21—His thoughts no mortal could even surmise.
22—The mountains soar above them to the skies.
24—The statue upward turns his nose and toes.
33—And spring, sweet, lovely, longed-for spring is here.
40—For here the flood in all its strength did rage.
52—The birds awake, their songs reach to the skies.

FI interspaced

F 8—The bird-notes mingled with the children's cries.
9—In frenzied gladness toward the darkened skies.
14—When the storms and rains greet us with surprise.
26—What is the matter, do you think with that man's eyes.
47—The earth a scroll is rolled into the skies.
57—For spring brings new life and added size.

FII

F 5—And blinking stars wink on this paradise.
10—And give to youthful eyes a glad surprise.
12—The birds sing songs; the animals grow wise.
20—Birds seek the water's depths: the porpoise flies.
27—The birds awake and earth is paradise.
28—In sheer unspeakable rapture so sweet.
45—And fleecy clouds sweep on across the skies.

FII interspaced

F 4—To join the breathless frolic of the May.
13—The mists melt; upon the hills the sunlight lies.
37—As though all nature were now despised.
51—A flood of summer sunshine fills the skies.
54—The mists above them hasten through the skies.
56—As if to meet some angels up there in the skies.

FIII

F 2—To meet the sun as he mounts the skies.
9—In frenzied gladness toward the darkened skies.
23—And joyous songsters flit through sunlit skies.
27—The birds awake and earth is paradise.
43—The buds do bloom, all nature welcomes spring.
44—And we must move, or else encounter flies.
46—When the winds blow and the rain downward flies.

FIII interspaced

F 15—And over all bends the encircling skies.
18—Reaching, it seems, to paradise.
29—The mountains smile and jocund are the skies.
32—As slowly up the trail we wend our way.
50—To bear on high their gladness to the skies.
56—As if to meet some angels up there in the skies.

FIV

F 7—The nestling first his tiny winglet tries.
19—The birds go swimming and the alligator flies.
26—What is the matter, do you think, with that man's eyes.
42—And human hearts like birds seek nests and skies.
54—The mists above them hasten through the skies.
55—In honor of the morning sacrifice.
57—For spring brings new life and added size.

There are no interspaced values for *FIV*.

Extras

A 14—The land that God had promised him so fair.
32—The burden of black dread, the weight of care.
50—In all the gay and festive games so rare.
57—The fun and frolic of the village fair.

B 14—No earthly friend forgive, nor penance pay.
15—The scars of sin, once made, forever stay.

C 2—Oft shed their light upon the inward mind.

D44—And all their virtues kindly magnifies.
45—And all their little glories magnifies.
46—Reflecting beauty where no beauty lies.
53—And each success unduly magnifies.

F 3—And spring once more has brought her glad surprise.
7—The nestling first his tiny winglet tries.

TABLE I

Keys Showing the Presumably Correct Order for Each Set of Lines of Poetry, and the Quality of Some Extra Lines

1. Identification	2. Sum of Grades	3. Times Judged Worse Than Succeeding Line	4. Times Judged Equal To Succeeding Line	5. 3 + Half of 4	6. Identification	7. Sum of Grades
			A I			
A13	66	14	10	19		
					A 8	81
A12	95	17	4	19		
					A42	112
A44	125	18	2	19		
					A16	144
A31	155	15	5	17.5		
					A60	171
A49	186	16	4	18		
					A28	206
A 3	217	15	10	20		
					A27	236
A37	251	17	6	20		
					A50	261
A57	275					
			A II			
A56	69	16	6	19		
					A 8	81
A47	100	19	2	20		
					A36	114
A 1	129	15	2	16		
					A 4	145
A22	160	14	3	15.5		
					A41	174
A25	188	18	3	19.5		
					A28	206
A35	220	17	6	20		
					A27	236
A37	251	16	7	19.5		
					A14	259
A32	277					
			A III			
A39	74	18	5	20.5		
					A26	90
A59	103	20	3	21.5		
					A21	121
A54	133	16	2	17		
					A 6	149
A 5	164	20	2	21		
					A34	178
A11	193	17	5	19.5		
					A40	209
A33	221	16	5	18.5		
					A27	236
A37	251	17	6	20		
A57	275					

1. Identification	2. Sum of Grades	3. Times Judged Worse Than Succeeding Line	4. Times Judged Equal To Succeeding Line	5. 3 + Half of 4	6. Identification	7. Sum of Grades
			B I			
B 6	60	18	8	22		
					B57	72
B41	92	19	0	19		
					B55	106
B28	121	19	3	20.5		
					B47	131
B54	150	16	2	17		
					B43	164
B12	180	16	3	17.5		
					B23	195
B 3	209	20	0	20		
					B24	225
B37	241					
					B15	255
			B II			
B 4	64	16	8	20		
					B27	83
B 2	96	17	3	18.5		
					B 8	109
B48	123	20	3	21.5		
					B58	143
B10	154	17	5	19.5		
					B22	170
B18	187	19	0	19		
					B40	200
B 3	209	20	0	20		
					B51	227
B37	241					
					B14	256
			B III			
B57	72	17	3	18.5		
					B 5	87
B55	106	15	11			
					B 1	117
B47	131	19	1	19.5		
					B54	150
B49	161	20	2	21		
					B12	180
B31	192	19	6	22		
					B17	207
B33	222	20	2	21		
					B46	235
B60	255					

TABLE I—*Continued*

1. Identification	2. Sum of Grades	3. Times Judged Worse Than Succeeding Line	4. Times Judged Equal To Succeeding Line	5. 3 + Half of 4	6. Identification	7. Sum of Grades
			C I			
C31	58	18	9	22.5		
					C57	78
C18	88	15	4	17		
					C25	103
C46	118	21	1	21.5		
					C40	134
C59	148	16	3	17.5		
					C27	163
C47	180	17	3	18.5		
					C42	193
C56	208	17	3	18.5		
					C 5	220
C41	236					
					C 2	255
			C II			
C34	58	19	6	22		
					C57	78
C22	87	16	8	20		
					C 4	105
C 7	117	17	1	17.5		
					C54	134
C19	149	18	1	18.5		
					C35	162
C47	180	17	4	19		
					C49	193
C10	206	19	4	21		
					C60	219
C55	236					

1. Identification	2. Sum of Grades	3. Times Judged Worse Than Succeeding Line	4. Times Judged Equal To Succeeding Line	5. 3 + Half of 4	6. Identification	7. Sum of Grades
			B IV			
B27	83	15	8	19		
					B 2	96
B34	111	18	4	20		
					B39	128
B58	143	17	4	19		
					B13	158
B29	173	17	7	20.5		
					B18	187
B 9	202	15	5	17.5		
					B56	220
B46	235	17	11	22.5		
					B37	241
B36	262					
			D I			
D12	66	20	6	23		
					D39	82
D43	97	15	4	17		
					D32	112
D 9	126	18	4	20		
					D33	140
D52	157	20	2	21		
					D21	171
D22	188	19	4	21		
					D48	201
D31	216	16	3	17.5		
					D60	231
D 6	244	21	2	22		
					D45	263
D44	280					
			D II			
D34	72	18	3	19.5		
					D11	86
D19	103	16	5	18.5		
					D36	115
D35	132	19	3	20.5		
					D 1	146
D23	162	18	3	19.5		
					D28	175
D38	191	20	3	21.5		
					D 8	204
D31	216	20	4	22		
					D40	233
D42	252	18	7	21.5		
					D53	268
D46	284					

TABLE I—*Continued*

1. Identification	2. Sum of Grades	3. Times Judged Worse Than Succeeding Line	4. Times Judged Equal To Succeeding Line	5. 3 + Half of 4	6. Identification	7. Sum of Grades
			C III			
C57	78	16	6	19		
					C37	97
C 4	105	19	1	19.5		
					C15	123
C45	137	16	4	18		
					C38	156
C21	169	17	5	19.5		
					C 9	183
C13	200	19	2	20		
					C20	216
C53	228	15	5	17.5		
					C52	242
C 8	260					
			E I			
E23	49	20	6	23		
					E15	66
E29	80	17	5	19.5		
					E13	93
E17	108	19	2	20		
					E50	125
E 8	141	17	1	17.5		
					E28	155
E44	173	19	4	21		
					E40	184
E41	200	19	2	20		
					E 1	214
E20	231	16	6	19		
					E26	245
E21	267					
			E II			
E14	84	21	1	21.5		
					E10	104
E37	115	17	2	19		
					E 6	130
E12	142	19	2	20		
					E57	161
E44	173	19	3	20.5		
					E19	190
E49	206	16	4	18		
					E11	219
E 2	237	16	6	19		
					E26	245
E21	267					

1. Identification	2. Sum of Grades	3. Times Judged Worse Than Succeeding Line	4. Times Judged Equal To Succeeding Line	5. 3 + Half of 4	6. Identification	7. Sum of Grades
			D III			
D37	79	18	3	19.5		
					D 5	92
D14	109	19	4	21		
					D 9	126
D33	140	17	4	19		
					D55	154
D27	171	17	2	18		
					D22	188
D48	201	15	6	18		
					D31	216
D57	229	20	4	22		
					D16	243
D45	263					
			F II			
F28	74	22	0	22		
					F37	91
F12	109	15	4	17		
					F56	121
F20	134	17	4	19		
					F 4	149
F 5	166	19	1	19.5		
					F13	181
F10	195	20	1	20.5		
					F54	207
F27	227	15	4	17		
					F51	244
F45	256					
			F III			
F44	82	16	4	18		
					F32	96
F43	109	19	0	19		
					F56	121
F46	137	21	2	22		
					F18	156
F 2	171	18	1	18.5		
					F15	185
F 9	204	17	2	18		
					F50	218
F27	227	17	5	19.5		
					F29	245
F23	259					

TABLE I—*Continued*

	F I				F II				F III				F IV			
1. Identification	F24				F26				F26				F26			
2. Sum of Grades	39				56				56				56			
3. Times Judged Worse Than Succeeding Line	19				20				20				20			
4. Times Judged Equal To Succeeding Line	6				3				3				3			
5. 3 + Half of 4	22				21.5				21.5				21.5			
6. Identification	F26	F57	F14	F47	F57	F14	F47	F 8	F57	F14	F47	F 8	F57	F14	F47	F 8
7. Sum of Grades	56	83	115	145	83	115	145	172	83	115	145	172	83	115	145	172
1. Identification	F57	F14	F47	F 8	F14	F47	F 8	F55	F14	F47	F 8	F55	F14	F47	F 8	F55
2. Sum of Grades	83	115	145	172	115	145	172	177	115	145	172	177	115	145	172	177
3. Times Judged Worse Than Succeeding Line	17	20	18	20	20	18	20	20	20	18	20	20	20	18	20	20
4. Times Judged Equal To Succeeding Line	0	0	1	2	0	1	2	2	0	1	2	2	0	1	2	2
5. 3 + Half of 4	17	20	18.5	21	20	18.5	21	21	20	18.5	21	21	20	18.5	21	21
6. Identification	F14	F47	F 8	F55	F47	F 8	F55	F54	F47	F 8	F55	F54	F47	F 8	F55	F54
7. Sum of Grades	115	145	172	177	145	172	177	207	145	172	177	207	145	172	177	207
1. Identification	F47	F 8	F55	F54	F 8	F55	F54	F 7	F 8	F55	F54	F 7	F 8	F55	F54	F 7
2. Sum of Grades	145	172	177	207	172	177	207	238	172	177	207	238	172	177	207	238
3. Times Judged Worse Than Succeeding Line	18	20	20	16	20	20	16		20	20	16		20	20	16	
4. Times Judged Equal To Succeeding Line	1	2	2	1	2	2	1		2	2	1		2	2	1	
5. 3 + Half of 4	18.5	21	21	16.5	21	21	16.5		21	21	16.5		21	21	16.5	
6. Identification	F 8	F55	F54	F 7	F55	F54	F 7		F55	F54	F 7		F55	F54	F 7	
7. Sum of Grades	172	177	207	238	177	207	238		177	207	238		177	207	238	

THE EFFECT OF ATTITUDE ON IMMEDIATE AND DELAYED REPRODUCTION: A CLASS EXPERIMENT

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It is well known that active recitation of matter to be memorized has a far better effect than mere passive reading or perception of it. Ebert and Meumann found, moreover, that the attitude of the learner, his "will to learn," exerts an important influence over his whole memorial result. They also found that particular adjustments of this attitude show themselves in a highly differentiated fashion. It was found, for instance, that if the reagent made it his intention to get the meaning (as) distinct from the words, he obtained much better reproduction of the meaning, and *vice versa*. Intention to learn associates by the method of paired-associates may result in the ability to recall all the associates for which one is asked even though the complete series cannot be recited, and, conversely, when the intention is to learn the series for the recitation test one may be unable to recall each syllable when its predecessor in the series is given though one's recitation of the series is fluent and free from error.[1] These various results, shading from those of direction of the attention to specific aspects in the learning to those resulting from the more general "will to learn," are certainly, as Meumann has pointed out, of much practical importance to the student and of interest to the psychologist.

To make more real to the student the significance of this determination to learn, as well as to afford him direct introspective experience with the difference between the active and the more passive attitude, the following experiment was carried out with two groups of college students, described on a later page. As no important sex differences were noted, results are not considered on this basis. The experiment seems to have several valuable features as a class exercise.

What difference will it make in later reproduction whether a person knows or does not know while reading a list of words that

[1] For authorities on these points see WITASEK, S., Zeitschr f. Psychol., 1907, XLIV, 161–185, 246–282. EBERT, E., AND MEUMANN, E., Archiv f. d. ges. Psychol., 1905, IV, 1–232. MEUMANN, E., *The Psychology of Learning*, tr. by J. W. Baird 1913, 303ff.

he will be asked to reproduce the words? This in brief was our problem, and from the nature of the case it could not be revealed until after the experiment was well on toward completion.

Two lists of common words were taken from SIMPSON, *The Correlation of Mental Abilities*, page 114, for the experiment. There were twenty words in each list, and the two lists were thought to be of approximately equal difficulty. The experiment was performed with sophomore students who were taking the second half of the course in general psychology in the university of Minnesota. When the class was assembled and the students had been provided with paper, the experimenter instructed them as follows: "I am going to write on the board a list of twenty words which each of you will kindly copy on the left margin of his sheet as I write them. Let us do this as soon as possible so that we can use the words in an experiment." As soon as the words were written the experimenter read them over once while each student checked his own list "to see that all the words were written correctly." Without any delay the students were then asked to fold over the left side of the paper so that the words could not be seen, the instructor illustrating how this was to be done. They did not yet know the purpose of the experiment. Now each was asked to write in another column near the concealed one, *in any order*, all the words of the list that he could recall. Time was not called until about a minute after all had ceased writing. The experimenter then re-read the list of words, asking each student to check carefully every word of the original list that occurred in his reproduced column, and to record the number.

The experiment was then repeated with a new list of twenty words and with this variation in procedure: the students were told that in the second case a reproduction would be called for as was done in the first, and each was encouraged to do as well as possible. To make this encouragement effective the students were informed that each one would be given his relative rank on this exercise. Conditions of time and of emphasis on the three kinds of impression—visual, auditory, and motor-tactual—were kept as nearly constant in both cases as possible.

The experiment was carried out in the manner just described in two different sections of the same course in psychology, the one section meeting at eight o'clock and the other at nine. The students of the first section were asked to be careful not to reveal

the nature or purpose of the experiment to those of the second. The details of the procedure in both of these sections were precisely alike, except that the series of words used were given in reverse order, so that the series used in the eight o'clock section "without determination," or without knowledge as to purpose, (called the passive series), was used in the nine o'clock section "with determination," or with knowledge as to purpose (*i. e.*, used as the active series). This reversal of order of the series of words used was intended to make up in a measure for the lack of standardization of the words. If one series of words should prove to be harder to reproduce than the other series this difference would presumably be noticeable by the reversal in the order just described. The two lists of words used are given on a later page in this paper.

After the experiment as just described had been carried out the papers were all collected and no intimation was made as to any further tests of the kind. It was, however, intended by the instructor to find the effect of the more active attitude on delayed reproduction. Accordingly, two days later, or precisely forty-eight hours after the first impression, the students were again asked to write down all the words of either list that they could recall.

The results of these experiments were gone over carefully from several standpoints. Two papers were excluded because of incompleteness of record and one because the student had suspected when the first series was given that a reproduction would be called for. The results of all other students are here given.

TABLE I.

Section I (The eight o'clock section)

Student	Passive List		Active List	
	Im. Rep.	Delayed Rep.	Im. Rep.	Delayed Rep.
A.....	14	9	18	12
B.....	13	9	7	3
C.....	12	5	16	14
D.....	14	5	11	9
E.....	7	2	13	11
F*.....	11	...	13	..
G.....	12	4	15	9
H.....	10	5	13	7
I.....	11	6	10	8
J.....	13	4	14	8
K.....	9	10	10	8
L.....	9	5	15	6
Totals.....	135	64	155	95
Av.....	11.25	5.82	12.92	8.63
A. D.....	1.75	1.95	2.28	2.14

* F was absent at the time of the delayed reproduction.

TABLE II.

Section II (The nine o'clock section)

A.....	9	3	9	6
B.....	6	4	10	8
C.....	9	11	13	8
D.....	15	8	14	9
E.....	6	6	14	12
F.....	10	7	18	15
G.....	16	5	13	7
H.....	12	13	16	14
I.....	12	8	15	13
J.....	9	6	14	16
K.....	9	6	15	10
L.....	9	6	14	13
M.....	11	6	13	10
N.....	9	8	14	13
O.....	13	7	15	12
P.....	13	7	17	12
Q.....	12	7	13	11
R.....	9	12	15	16
S.....	6	2	6	4
T.....	13	6	13	8
U.....	9	3	13	6
V.....	11	9	15	12
W.....	10	6	15	8
X.....	10	3	12	5
Y.....	6	6	11	8
Z.....	12	9	13	14
AA.....	9	7	8	10
BB.....	12	5	15	14
CC.....	9	10	12	12
Totals.....	296	196	385	296
Av.....	10.21	6.77	13.27	10.21
A. D.....	2.04	1.93	1.85	2.80

From these tables it will be noted that in Section I 75% of the students made a better record with than without determination in immediate reproduction, and 82% of the students made a better record with determination in the delayed reproduction. In Section II the corresponding percentages are 83 and 97, respectively. Comparing the total words reproduced by each of the two sections we find that

In Section I[2]

Immed. Reprod. with determination was 14.8% better than without deter.

Delayed Reprod. with determination was 48.4% better than without deter.

In Section II

Immed. Reprod. with determination was 30.0% better than without deter.

Delayed Reprod. with determination was 51.0% better than without deter.

It is important to note that the gain in delayed reproduction—the delay period it will be remembered was 48 hours—is considerably greater than in immediate reproduction, being about 50% as against 14% to 30%. It is well known that unassociated content, such as nonsense syllables, fades from the mind more rapidly at first than meaningful or associated material. It is natural therefore to expect a greater gain with the active attitude, as we actually obtained, in the delayed reproduction than in the immediate reproduction. This greater gain with delayed reproduction would seem to give us a valuable suggestion as to just what the difference is in the two attitudes studied in this

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[2] When the "probable errors" of the average number of words reproduced per student are taken into account, which procedure is advisable because of the small number of subjects tested, these results will stand as follows:

In Section I

Immed. Reprod. with deter. is 6 to 25% better than without deter.

Delayed Reprod. with deter. is 28 to 73% better than without deter.

In Section II

Immed. Reprod. with deter. is 23 to 37% better than without deter.

Delayed Reprod. with deter. is 38 to 65% better than without deter.

It is, of course, evident that the results from the smaller section (Section I) are more variable, therefore, less reliable, than those from the larger section. The gain due to the active attitude is obviously considerable. The probable errors for this calculation were derived from the average deviations, given in the text, by the formula

$$\text{P. E.}_M = \frac{0.8453}{\sqrt{n-1}} \text{ A. D.}$$

paper. It would seem that the active attitude (with determination) differs from the passive in other and more important respects than in merely making the stimulus more intense. There is evidence also of better association in the active attitude.

This evidence is corroborated by the introspective reports of the students. Each student was asked as soon as the immediate reproductions had been completed to write out a careful statement of any differences that he had noted or could recall between the methods of his "receiving," or being impressed by, the so-called active and passive series of words, respectively. In the case of the active list of words some of the students report that they went faster and repeated words, but generally the introspections abound with evidences of association in various ingenious ways. I give the chief types: "I tried to keep in mind words that occurred together"; "tried to associate each word with something, e. g., *light* with our new light at home, *late* with returning home late"; "made sentences out of some of the words, and associated others"; "associated *tall* with *friend*, also the first letters of several of the words"; "I connected *big, tall, thin, empty*, etc."; "associated words of similar endings, as *rich, sick*"; "associated words similar in meaning, as *good, glad, happy*"; "was more alert and associated the words"; "tried to connect words with something, as *empty* chair, *false* prophet, etc."; "tried to memorize them (!) while in the passive list there was no such motive." And so on. The other section found their "active" list no less susceptible of associations. For instance, "associated *stale, dirty, hot, heavy, sour.*"

The students were of course not experienced in introspection. Interesting evidence of a wholly objective kind was fully as illuminating as the introspections, and frequently gave certain evidence of associations not noted in the introspections at all. This type consisted of the occurrence in the reproductions of words not among the stimulus words (see lists below), and also of various methods of grouping the reproduced words, i. e., of the various orders in which the words were recalled. Some students gave the order backwards to a considerable extent, others gave the words nearly in their original order, while still others grouped them significantly, as their introspections would lead one to expect. A careful study of the groupings of various words recalled in delayed reproduction would doubtless reveal not a little

of the contents of the subjects' minds even though wilful rearrangements could not so easily be prevented as in certain experiments in association.

Another means of getting at the associations effective in our present exercise is afforded by the frequency of occurrence in the total reproductions of each of the stimulus words. Each paper was gone over very carefully and tallies were made of the frequency of reproduction of each word. The results are contained in the following tables. These tables consist of each of the stimulus lists, both the active and the passive as given to each section, and also of the frequency of occurrence of each word in the reproductions in both the passive and active list of each section. These frequencies may be used for the double purpose of throwing light on the relative effectiveness of the secondary laws of association—frequency, recency, primacy, and vividness—and also of affording a means of determining whether the individual words and the two lists of words were of approximately equal difficulty. It will be remembered that the two lists were reversed in order for the two sections, so that the active list for Section I became the passive list for Section II. In Table III, P and A, after the section numbers, stand for active list and passive list, respectively. I. R. is for immediate reproduction, D. R. for delayed reproduction. The figures under these letters give the number of persons, or the total number of times possible for any word to occur. The totals of the columns here must, of course, equal the totals of the corresponding columns in the other tables, I and II.

TABLE III.

Stim. Words X	Sec. I, P. Freq. in I. R. 12 O's	Sec. I, P. Freq. in D. R. 11 O's	Sec. II, A. Freq. in I. R. 29 O's	Sec. II, A. Freq. in D. R. 29 O's	Stim. Words Y	Sec. I, A. Freq. in I. R. 12 O's	Sec. I, A. Freq. in D. R. 11 O's	Sec. II, P. Freq. in I. R. 29 O's	Sec. II, P. Freq. in D. R 29 O's
good	9	4	24	13	stale	11	8	26	12
outside	6	3	25	13	hot	10	7	19	7
quick	5	2	20	8	dirty	9	4	20	11
tall	11	3	22	18	heavy	8	3	5	4
big	6	2	20	18	late	10	7	17	13
loud	5	1	11	8	first	4	3	8	5
white	5	4	16	24	left	5	2	5	1
light	8	6	19	24	morning	10	7	15	12
happy	7	5	17	17	much	4	1	9	5
false	11	4	14	7	near	4	1	10	7
like	7	5	13	12	north	11	8	21	21
rich	7	3	20	23	open	6	6	13	7
sick	10	3	22	21	in	11	8	28	28
glad	3	4	13	13	sharp	4	2	10	6
thin	6	1	18	8	east	9	7	18	18
empty	4	1	17	10	sour	9	2	17	8
war	8	6	24	21	something	7	7	14	9
many	8	1	24	15	stay	6	3	10	4
above	1	1	18	7	push	5	3	11	4
friend	8	6	28	16	nowhere	12	6	20	14
Totals	135	64	385	296	Totals	155	95	296	196
Av.	6.8	3.2	19.5	14.8	Av.	7.8	4.8	14.8	9.8

Among the reproductions were found the following words, a number of which reveal clearly trends of associations present in the subjects' minds during the impression and reproduction: *shut, last, far, party, time, new, west, with, early, rather, somewhere, window, south, here, nothing, stage, bright, take, place, black, life, short, duty, cold, bread, haste,* and *far.*

It seems likely that the two sets of stimulus words, X and Y, are not seriously unequal in difficulty of reproductions. The X series seems to be slightly easier, if there is any real difference. It is very difficult to get a homogeneous group of meaningful words. Table III shows that some of the words actually used were comparatively easy to recall while others were hard. These differences, however, are about equally distributed in the two series, X and Y. It is not easy to understand why such words as *above, empty, much, near,* and *heavy* should be so much harder to reproduce than *in.* Words relating to direction, and to certain frequent and important experiences, such as *late* (we had frequently emphasized in the class the necessity of being on time), *sick, war,* were retained well. *Light* and *white* were usually asso-

ciated together as was evident from the fact that they were usually both reproduced together or both omitted. This of course greatly increased the probability of the recall of each of the two words. This is unquestionably true also of other groups of words in the lists. Because of these conditions, producing a lack of homogeneity in the stimulus words, it is not safe to attribute much influence to primacy and recency, even though the first and the last words in each series were recalled with more than normal frequency.

In a somewhat similar study by Miss Mulhall, on the effect of determination on recall and recognition,[3] in which syllables, forms, words, and photographs and names were used, it was found that the effect of determination on recognition was very small in comparison with the effect of determination on recall; but as the methods were not alike in the two experiments it is impossible to compare our results quantatively with hers. She found the difference between the effect of determination on recall and on recognition greatest on pictures, greater on forms than on words, and greater on words than on syllables. These results would seem to suggest, as do ours, that the "will to learn" shows itself most effectively in material affording easy and numerous associations.

What, then, is the nature of this determination or "will to learn?" Does the difference between this state of mind and the more passive attitude consist mainly in making the impression more vivid, or intense, by greater clearness of attention? This seems improbable from the results. Will is now regarded by psychologists, as a rule, not as a mysterious adding to the dynamic force of the individual, but rather as a complex result of various stimuli acting both directly and indirectly upon a mechanism which is partly inherited and partly acquired. That is to say, will is conditioned by circumstances. The additional stimulus in our experiment that brought about the will to learn was the statement to the students before giving the active list of words that they would be asked to reproduce the words. This statement, operating by association through various neural dispositions, produced a much more definite response attitude than was possible in connection with the passive list, and thereby made

[3] MULHALL, EDITH F., "*Experimental Studies in Recall and Recognition*," *Amer. Jour. Psychol.*, 1915, XXVI, 217–228.

possible certain definite associations. Whether this is the same thing as saying that the attention was more concentrated on the words in the active list is a question. Intensity of stimulation, moreover, may mean any of several things. Too frequently it is taken to mean merely the physical intensity. It also and particularly means, with respect to behavior, that the stimulus is closely connected with response dispositions. From this point of view only was the stimulation greater in the list of words given with determination to learn. It seems to be true that the will to learn is not very effective if one is permitted merely to observe as actively as possible the series of words presented, but not to associate them;[4] but this is merely putting a restriction on one's readiness for response. It must be admitted that we are not yet in a position to say in just what this will to learn consists, either psychically or neurally. It appears that the active attitude brings into coöperation a number of factors, though just how this is brought about is one of the many questions in psychology which we shall be a long time in answering.

[4] MULLER AND SCHUMANN, cited by LADD AND WOODWORTH, *Elements of Physiological Psychology*, p. 582.

A STUDY OF MENTAL FATIGUE WITH A GROUP OF FIVE BOYS

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Nature and Aim of the Experimentation

This study of mental fatigue consists of an examination of five boys about thirteen years of age. The following tests were given:

1. The first test consisted of a one-digit continuous addition test lasting two hours, the aim being to secure the work curve and the degree of sustained attention and degree of fatigue that would appear in the case of a child. Kraepelin's additions as arranged by Stoelting and Company were used (Whipple, "Manual of Mental and Physical Tests," vol. II, 97).

2. The addition test was preceded and followed by a discrimination of grays test. This test was inserted as an experiment on a suggestion made by Meumann a few years ago that other sensory fields besides the cutaneous (*i. e.* the aesthesiometer tests) might offer less mechanical difficulty, and be less at the mercy of suggestion, and demand just as high a degree of discrimination, and consequently make a better fatigue test. The material for the test consists of a color mixer with black and white disks. When rotating the disks produce the following effect upon the eye; first an outer circular band of gray, then an inch circular strip of white, and finally a circle of gray in the center. The outer circle of gray constituted the norm of comparison, on the inner circle could be secured minimal changes in gray. The unit of variations was 5 degrees of black, varying from 130 degrees of black to 210 degrees. The usual precautions of neutral background, uniform conditions of light, etc., were taken.

3. The third test consisted of mental multiplication (a three-place by a one-place number), and simultaneous mental addition. The work lasted two hours. The aim was to secure as nearly as possible a purely mental work, and to contrast the efficiency in the first and second hour. The first addition problem started with 7 and 6, alternately adding 2 to the 7's column and 3 to the 6's column. The second addition problem started with 5 and 9,

adding respectively 3 and 2 (Whipple, "Manual of Mental and Physical Tests," vol. I, 338).

4. Before and after the test just mentioned Scheiner's experiment of the accommodation of the eye was given. The enthusiasm of Dr. A. Baur over this test of mental fatigue led to its use in this study. (Sanford, "Experimental Psychology," 90. Titchener, "Instructor's Manual, Qualitative," 236 ff. Inter. Mag. of S. Hygiene, VII, 52-92. Baur, "Die Ermüdung im Spiegel des Auges.") As test three practically eliminated eye strain, this seemed an excellent place to study correlation between accommodation and a purely mental situation.

Preliminary drill was given until each test was thoroughly familiar to each subject.

General Condition of Experimentation

The five boys selected for the tests were normal in every respect, perhaps a little superior in intelligence but not precocious. They tested above normal with the Binet tests, but home conditions were in every case above average. The aim was to get normal and dependable workers. Physical tests revealed no eye or ear defects, while the general health was good in every case. The boys ranged in age as follows; H-T, 13 yrs., 8 mo., H-D, 13 yrs., A-K, 13 yrs., E-H, 12 yrs., 8 mo., A-J, 12 yrs., 2 mo. The testing and preliminary practice were always individual, and sometimes during the forenoon. The set work periods of two hours were always on holidays, and from 8 to 10 A. M. Drill to eliminate practice effects and to secure uniform response preceded the final use of the tests in the work curves. Preliminary practice also preceded the use of the discrimination of grays test and the Scheiner experiment.

Care was taken to avoid suggestion and to provide incentive. When the boys were asked to act as subjects they were told that business men constantly complained that the schools did not teach the students to do arithmetic quickly and accurately. The experimenter told them that after a little drill he planned to have them work at addition and multiplication and he hoped their records would show that they could work accurately and rapidly for a long time. *No suggestion was given concerning fatigue.* To secure the best possible response the boys were paid twenty-five cents an hour, and the implication was that they were to conduct them-

selves as any paid clerks. When marked variations appeared in the work curve questions were asked to ascertain if a local cause could be found. The complete elimination of suggestion seems of primary importance combined with a favorable emotional attitude.

Addition Test

Method of procedure. In the addition test the subject was given the following instructions:

1. Add aloud as fast as you can, but try not to make any mistakes.
2. Add each number separately and in turn to your partial sum.
3. *As soon as a mistake is made I will call, "No," and give you the correct partial sum at that point.*
4. Do not repeat the first digit in beginning a new addition.

The object in correcting the error in addition was two-fold; first, to aid the experimenter in scoring mistakes, and second, to hold the subject to a high standard of accuracy by making him aware of his mistakes *at the time of their occurrence.* A new addition was begun every ten digits. There was no intermission during the addition period except a pause for a sip of water, to change position, and to take introspection in rare cases. The total period during which addition was carried on was thus a little over two hours.

In the discrimination of grays test the subject was asked to state his judgment as follows: (1) the inner gray is lighter than the outer, (2) the inner gray is darker than the outer, (3) the grays are equal.

Results from the Addition Test. Continuous oral addition is primarily concerned with mental processes, but fatigue of throat and eye are both theoretically possible. However, neither voluntary introspections, nor direct questions at the close of the two-hour period elicited any complaint of eye strain. (The activity of the external muscles of the eye would, of course, be much less than for an equal period spent in reading.) All of the subjects, however, complained of some difficulty from the continuous speaking. This however was not noticeable until after the first hour's work. H-T who added very rapidly became somewhat husky at the last. In his case, the sudden low score after forty-five minutes work was accompanied by a request for a drink.

With all the subjects it is safe to say a general decrease in rate is partially due to this cause.

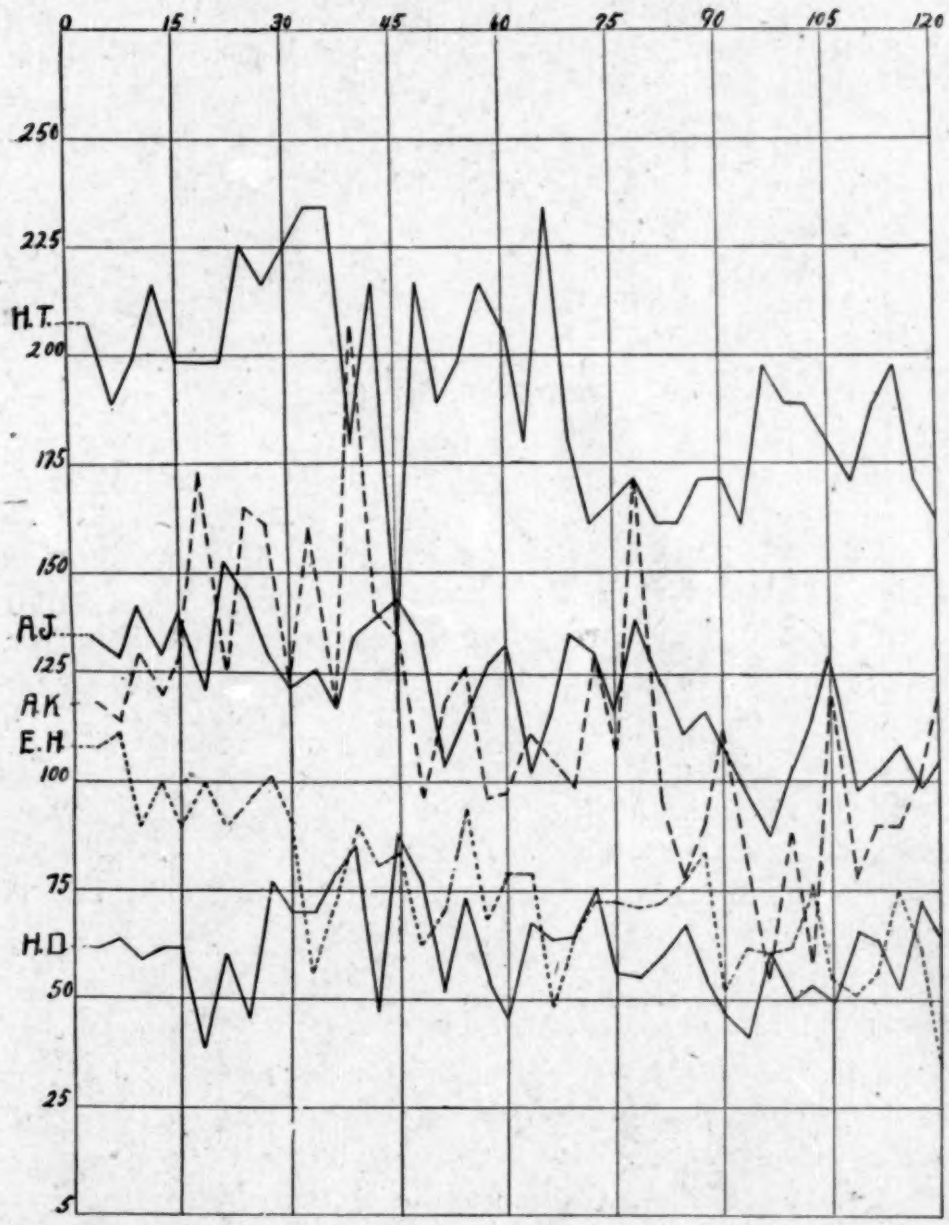
1. A study of the curves (Tab. I, Graph I) will show that no appreciable decrease below the initial speed occurred during the first hour's work, with the exception of E-H. In the second hour's work, the quantity is considerably less with the exception of H-D, whose rate is the lowest, and also the most uniform.

Subject	1 Percental decrease in quantity during second hour	2 Percentage of errors during first hour	3 Percentage of errors during second hour
H–T.....	10.3	.8	.8
H–D.....	6.7	6.7	5.5
A–K.....	24.9	3.1	4.4
E–H.....	15.6	7.2	8.8
A–J.....	14.7	2.5	2.8

2. Many studies of fatigue indicate an increase in speed and a decrease in accuracy as the work prolonged. A comparison of columns 2 and 3 in the preceding tabulation shows that the quality remained fairly constant. Of course, *the checking of every mistake at the time of its occurrence tended to check a progressive drift into inaccuracy*. While the total number of errors for all the subjects was greater during the second hour, with three of the five a larger number of mistakes was made during the first hour. However, totals considered in terms of percental decrease based on the total quantity score yield but a small per cent. A decrease in accuracy is not demonstrated. When one considers that the work was far more strenuous than an equal time spent in school work, in its monotony, enforced sedentary conditions, length, and the throat strain involved, the decrease in quantity is not great.

It is interesting that the two boys who made the lowest percental decrease in the quantity score the second hour also had as few or fewer errors the second hour. In fact, H-D had a better accuracy score the second hour, but it must also be noted that his rate was the lowest of any of the boys and his absolute number of errors the greatest of any of the boys during the first hour, with the exception of E-H.

An examination of the distribution of errors (Tabulation I) does not indicate that there is any *progressive trend*. Often five or ten errors are recorded for a period of three minutes. Turning to the



GRAPH I

Continuous One place Additions
Horizontal numbers = minutes.
Vertical numbers = additions

TABULATION I. CONTINUOUS ONE-PLACE ADDITIONS

Each No. Indicates a Period of 3 Min.	First Hour										Each No. Indicates a Period of 3 Min.	Second Hour									
	H. T.		H. D.		A. K.		E. H.		A. J.			H. T.		H. D.		A. K.		E. H.		A. J.	
	Errors	Total No. of Additions	Errors	Total No. of Additions	Errors	Total No. of Additions	Errors	Total No. of Additions	Errors	Total No. of Additions		Errors	Total No. of Additions	Errors	Total No. of Additions	Errors	Total No. of Additions	Errors	Total No. of Additions	Errors	Total No. of Additions
1	1	207	3	62	4	117	3	108	5	135	21	2	180	3	67	3	111	2	79	3	103
2	2	189	1	64	3	113	61	11	4	128	22	2	234	6	64	5	105	10	48	2	117
3	2	198	6	59	3	130	5	90	1	141	23	2	180	3	65	3	99	5	65	2	135
4	0	216	5	62	4	120	4	99	2	129	24	3	162	2	75	3	131	6	72	1	131
5	3	198	2	62	5	130	4	90	3	140	25	3	171	3	56	5	108	4	72	3	117
6	2	198	3	38	1	174	5	99	4	121	26	1	171	2	55	2	172	4	71	0	138
7	2	198	4	60	2	126	2	90	2	153	27	2	162	2	60	6	96	7	72	4	122
8	2	225	5	45	3	165	11	95	2	144	28	1	162	2	67	6	77	6	77	3	112
9	1	216	4	76	2	161	6	101	2	130	29	1	171	3	54	4	91	3	84	4	117
10	2	225	4	70	5	124	4	92	4	122	30	2	171	5	47	5	112	6	53	2	108
11	2	234	3	70	5	160	10	56	5	126	31	1	162	4	41	5	82	8	62	7	96
12	1	234	2	79	5	119	5	72	5	117	32	0	198	6	61	4	55	5	61	5	84
13	2	180	5	86	3	207	4	90	4	135	33	2	189	3	50	5	98	4	62	6	104
14	1	216	8	47	1	141	4	81	3	140	34	1	189	1	53	5	59	2	76	1	115
15	1	135	5	88	5	135	5	94	3	143	35	1	180	3	50	6	120	6	55	1	130
16	0	216	4	77	6	96	10	63	4	135	36	1	171	1	66	3	78	5	51	3	98
17	3	189	3	53	5	119	7	70	4	104	37	2	189	4	64	4	90	8	56	3	102
18	1	198	5	73	7	126	5	94	3	126	38	1	198	4	53	4	90	4	75	2	108
19	3	216	5	54	5	96	4	67	3	126	39	1	171	3	73	6	101	6	63	7	99
20	3	207	8	46	7	97	7	79	2	132	40	2	162	5	65	4	120	10	36	3	105
	34	4095	85	1271	82	2656	111	1741	65	2627		29	3573	65	1186	88	1995	114	1290	62	2241

NOTE—Second hour's work was a continuation of first hour's—put in separate tabulation for purposes of contrast.

introspections and attitude of the subject, there is an indication of embarrassment and confusion arising out of the consciousness that errors were being made in quick succession. This condition seemed to be especially true of A-K, who would blush, stammer and make nervous haste at such times. Apropos to the discussion of errors and the emotional factors involved, H-T should be considered. He was by far the most rapid and most accurate of any of the subjects. Also his *ideal of accuracy was high.* While his groups of continuous errors are always short, the emotional element is pronounced. A study of his graph shows that there is a correlation between reduction in speed and reduction in accuracy. His attitude and introspections would both indicate that emotional element played an important part.

While it is perhaps true that fluctaation of attention helped to initiate a group of errors, it is also most certainly true that an unfavorable emotional element tended to prolong the group. Embarrassment, chagrin, vexation, a psychological hoodoo—the suggestion "now I have started to make mistakes I'll make them," all tended to decrease the efficiency when once inaugurated, yet they are not factors of fatigue proper.

No attempt has been made to reduce quantity and quality to a common score. While they are related they do not have a common denominator and any attempt to reduce to a single value must be an arbitrary matter.

3. The question of speed. The directions were, "Add as fast as you can but try not to make mistakes." However, the speed was not so great as in some of the preliminary drills in the case of H-D and possibly with some of the other subjects. There seemed to be an unconscious adjustment to a judicious speed compatible with prolonged effort, somewhat similar to the attitude and adjustment for the 100-yard dash or the mile. This adjustment appeared again in the multiplication, a situation similar to that in Arai's experimentation. The question should be raised in long periods of work whether there is not just such an adjustment, unconscious to be sure, but nevertheless concealing a decrease in speed that would have been evident had the initial speed been absolutely the maximum. Practice effects would also tend to be reduced.

4. Summary. The two-hour work period in addition does not indicate any marked or uniform reduction in accuracy. There is a progressive reduction in quantity after the first hour. The appearance of this reduction *after* the first hour's work, with the exception of E-H, combined with a sustained accuracy, would seem to indicate that the average work period in the school with the constant change and variety is not a mental tax to the average student. Introspection and the attitude of the students indicate that throat fatigue was more prominent by far than an unpleasant mental condition.

Discrimination of Grays (Tabulation II)

The results are neutral. While the total number of mistakes was greater than before the additions, three of the boys showed more errors *before* than *after*. A comparison of the differences

before and after shows about the same fluctuation in the individual response that was found in the trials from day to day, where the factor of fatigue was not involved.

TABULATION II

Discrimination of Grays

Degrees	H. T.		H. D.		A. K.		E. H.		A. J.	
150*.....	l	l	l	l	l	=?l	l	d	=	l
180*.....	=	=	d	d	d	d	d	=	ld	=
210.....	d	d	d	d	d	d	d	vd	d	d
205.....	d	d	d	d	d	d	d	vd	d	d
200.....	d	d	d	d	d	d	d	vd	d	d
195.....	d	=	d	d	d	d	d	vd	d	d
190.....	=	=	d	d	d	=	d	d	=	ld
185.....	=	=	d	d	d	=	d	ld	=	=
180.....	=	=	d	=	=	=	ld	ld?	=	=
175.....	l	l	d	=	=	=	=	=	ll	=
170.....	=	l	=	l	=	=	=	=	ll	l
165.....	l	l	=	l	l	=	=	=	ll	=
160.....	l	l	l	l	l	=	=	=	ll	=
155.....	l	l	l	l	l	l	=	l	ll	=
150.....	l	l	l	l	l	l	l	l	ll	=

l = lighter
ll = a little lighter
d = darker
ld = little darker
v = very

Tabulation of Errors

Subject	Before	After	Last drill
H–T.....	2	6	3
H–D.....	6	5	5
A–K.....	4	3	3
E–H.....	2	5	2
A–J.....	4	1	4

MULTIPLICATION, ADDITION AND SCHEINER'S EXPERIMENT

Method of Procedure. The tests were arranged in the following order:

1. Scheiner-Baur accommodation of the eye test.
2. ¾ hr. of multiplication.
3. ¼ hr. of simultaneous addition.
4. ¾ hr. of multiplication.
5. ¼ hr. of addition.
6. Repetition of Scheiner-Baur test.

The time indicated is the net time of the actual mental work, exclusive of instructions, slight interruptions, etc. In the multi-

*Preliminary test.

plication test the problem was placed on a slip of paper. The following instructions were given: "Get the problem in mind, place the slip face downward, close your eyes if you desire to and multiply as fast as you can without making mistakes." In the addition test the subject had been taught to take the addition verbally as follows: "Start with 7 and 6, add 2 to the 7 and 3 to the 6. Ready. Add." Or in the second case, "Start with 5 and 9, add 3 to the 5 and 2 to the 9. Ready. Add." When an error occurred, the experimenter stopped the subject with "No," and supplied the correct partial sum or sums. This seemed desirable to avoid a careless lapse as regards accuracy, and also there was the tendency to make errors which reduced the difficulty of the addition after the initial error: *e. g.*, 62—42, or 63—67, for 62—47. In the preliminary practice it became evident that there was a common tendency to reduce the partial sums to an identity either in the units or else in the tens. In some cases one or both of the partial sums were lost by the subject. Such cases were scored as errors. In scoring the multiplications account was kept of the total number of digits in all the products. An error was scored for each incorrect digit.

TABULATION III

Multiplication

Name	First ¾ Hour			Second ¾ Hour		
	Total No. of Figures	Errors	Percent. of Errors	Total No. of Figures	Errors	Percent. of Errors
H. T.	239	34	13.2	320	56	17.5
H. D.	139	24	17.3	136	24	17.6
A. K.	119	30	25.2	120	40	33.3
E. H.	151	61	40.4	228	101	44.3
A. J.	199	31	15.6	304	33	10.9

Simultaneous Addition

Name	First ¼ Hour			Second ¼ Hour		
	Total No. of Figures	Errors	Percent. of Errors	Total No. of Figures	Errors	Percent. of Errors
H. T.	320	20	6.3	312	31	9.9
H. D.	180	31	17.2	170	24	14.1
A. K.	154	27	17.5	178	23	12.9
E. H.	236	32	13.6	186	43	23.1
A. J.	214	29	13.6	198	32	16.2

Results in the Multiplication Test (Tabulation III)

1. There was an absolute increase in the number of errors during the second period of multiplication in every case except one, H-D. There was also a percental increase with the exception of A-J.

2. As stated in connection with the one-place additions any attempt to reduce quality and quantity to a common denominator is an arbitrary matter. However to simplify the situation a comparison of the *correct* number of figures in the first and in the second period is given.

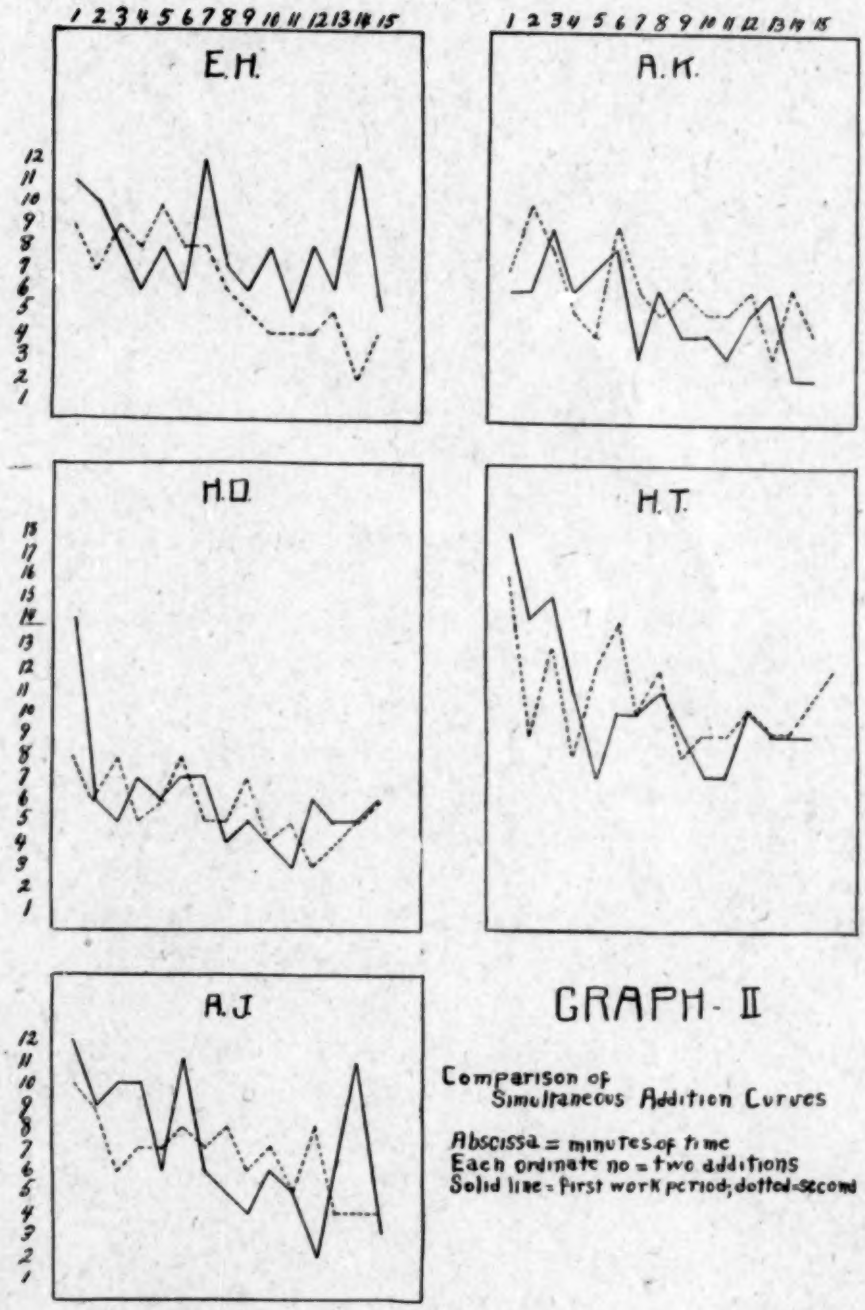
Subject	First period Quality-Quantity score Total number correct figures	Second period Quality-Quantity score Total number correct figures	Percental gain or loss in the second period
H–T.....	205	264	plus 29%
H–D.....	115	112	minus 3%
A–K.....	89	80	minus 10%
E–H.....	90	127	plus 41%
A–J.....	168	271	plus 61%

It will be noted that three of the five boys made a higher absolute score of correct figures in the second period. While there was an increase in rapidity during the second period of work, the absolute increase in correct report forbids saying there was an increase in speed at the expense of accuracy. In two cases, H-T and E-H, there was an absolute increase in inaccuracies during the second period: here nevertheless there was also an absolute increase in the second period in the correct number of figures. There was no trend towards increased inaccuracy during the second period.

3. A contrast of the first period of work with the second period of work makes it very difficult to say that there was any *constant trend* in the factors in the second period which would warrant a generalization concerning fatigue. In view of the monotonous character of the multiplication, and the length of the work period compared with the schoolroom, there seems little warrant from a study of the mental output for the belief that appreciable fatigue is present in the ordinary work period of the school-room.

Results in Addition (Tabulation III Graph II)

1. With three of the five subjects there was an absolute increase in errors during the second period of addition. In one case the



GRAPH- II

Comparison of
Simultaneous Addition Curves

Abscissa = minutes of time
Each ordinate no = two additions
Solid line = first work period; dotted = second

increase was slight, A-J. As errors were corrected at the time of their occurrence there was probably a tendency to reduce both the number of errors and the speed. In three of the five cases there was a percental increase in the errors made. Subtracting one from the total addition score for each error made, we have the following qualitative-quantitative score.

Subject	First period Number correct figures	Second period Number correct figures	Percental loss or gain
H–T.....	300	281	minus 7%
H–D.....	149	146	minus 2%
A–K.....	127	155	plus 23%
E–H.....	204	143	minus 30%
A–J.....	185	166	minus 10%

In the absolute number of additions and in the absolute number of correct additions the first period of work surpassed the second period of work with the exception of A-K. In two cases the percental decrease in the second period is slight. In the case of E-H the percental and absolute decrease was marked as elsewhere with the exception of the multiplication tests where there was no check on accuracy, and in this case there was an enormous percentage of errors, in the first half of the experimentation 40.4% and in the second half 44.3%.

Judging from the tests given it would seem that the simultaneous addition tests give the most uniform symptoms of fatigue. The addition demands a sustained continuity of attention, memory span, and an exact constructive process in association. To the writer, however, such results are not at all conclusive that mental fatigue is present. The artificial nature of the problem, the lack of any strong incentive, the monotony of the situation, all could be factors in decrease in efficiency as well as fatigue.

Results of the Scheiner Experiment (Tabulation IV)

It will be kept in mind that the nature of the addition and multiplication reduced the eye strain to practically nothing. Any effect on the ciliary muscle would then have to be either part of a general decrease in muscular efficiency, or a decrease in some mental factor as attention. The supposition would seem to be that the accommodation of the eye involving a peculiarly delicate muscular adjustment would be more easily effected, while in the nature of the case the fluctuation in the near-point of vision would offer an excellent *degree* score.

TABULATION IV.

Scheiner's Experiment

Right Eye

	H. T.		H. D.		A. K.		E. H.		A. J.	
No.	B	A	B	A	B	A	B	A	B	A
1	14.5	15	12	11	16	14.1	9.7	12.4	9.2	10.1
2	15	14	9.1	10.1	15.8	17.3	12.2	13.1	10.7	10.4
3	16.5	13	13.3	12.3	17.2	18.2	11.8	10.8	8.2	8
4	12.2	14.5	9.5	9.2	17.4	18.5	14	11	7.9	8.9
5	14.5	15.3	12.5	12	14.1	15.8	12.8	11.3	11.1	8.1
Ave.	14.5	14.3	11.3	10.9	16.1	16.8	12.1	11.7	9.4	9.1
	*1st	†Total	1st	Total	1st	Total	1st	Total	1st	Total
	19.3	14.8	12	11.5	17.5	16	13.8	13.5	20.7	10.1

Left Eye

	H. T.		H. D.		A. K.		E. H.		A. J.	
No.	B	A	B	A	B	A	B	A	B	A
1	15	16	10	10.8	17	15.5	13.5	11.4	8.7	9.5
2	15	13	13.4	14.1	17.1	16.3	12.6	11.5	9.7	10.4
3	12	14.5	13.5	13.1	16.4	16	12.5	14.1	9.9	8.3
4	12.5	14.5	14	12.3	15.3	18	12.4	14	10.5	11.2
5	14	12	9.3	12.1	16.6	14.2	13.9	12.6	8.1	8.9
Ave.	13.7	14	12	12.5	16.5	16	13	12.7	9.4	9.7
	1st	Total	1st	Total	1st	Total	1st	Total	1st	Total
	15.1	14	14.5	13.1	16.9	16.5	14.5	14.1	10.3	9.8

NOTE—
B = Before two hours addition and multiplication.
A = After two hours addition and multiplication.
* 1st = First preliminary test.
† Total = Average of all the preliminary trials.

The results are given in Tabulation IV. The averages do not indicate any constant difference or any particular trend. In fact they are without significance as far as fatigue goes. In any case, a comparison of the average when used as a fatigue test with the average for all the preliminary tests and the first preliminary test will show that there is about the same fluctuation in every trial. In the school situation, the local sensory fatigue of the eye is evidently the cause of the marked difference in the variation of the near-point of vision noted by Baur. Furthermore, the fluctuations in the preliminary tests indicate that it is doubtful if a norm even for rough practical purposes could be established where a large number of children are to be tested but once.

COMMUNICATIONS AND DISCUSSIONS

SOME CORRELATIONS BETWEEN LEARNING AND RECALL

In a study of Confusion (unpublished) the writer tested individually 50 normal school girls. Each was told to study a given group of words and figures so that she could reproduce them in exact order and that she would be given all the time she wanted both for learning and for recall. Time was recorded with a stop watch for both procedures.

The average learning time was 509.2 sec.; median, 473 sec.; M. V. from median, 14.92. For the recall time the corresponding figures are 174.3, 133 and 8.50. The highest learning time was 1058 sec.; lowest, 105 sec. For recall they were 463 sec. and 54 sec. respectively. The distribution for both "times" show wide variations toward the upper limit. The upper quartile for learning time was 672 sec., the lower quartile 383 sec. The respective quartiles for recall were 268 and 90.

The correlation between the learning time and recall time was —.380 (P. E. .0816). This negative correlation indicates that when the learning time was high the recall time was low and vice versa. It probably means that the individual who took plenty of time in making certain her learning was more certain in her reproduction.

Since the task was perfect reproduction no fair coefficient of correlation between amount recalled with learning time or with recall time could be determined. However, 27 cases had from one to 6 points wrong, with an average of 3 points in omissions and displacement. The average learning and average recall times in seconds for perfect reproduction and imperfect reproduction are given below:

Learning Time

Perfect reproduction		Imperfect reproduction	
Av. 531.2	Med. 492	Av. 490.1	Med. 438

Recall Time

Av. 122.7	Med. 90	Av. 219.6	Med. 224

These figures indicate that the learning time for perfect reproduction was higher, as a rule, than for imperfect reproduction while the time for perfect recall was decidedly less than for imperfect recall.

Some individuals, however, with perfect recall had very high recall-time while others with imperfect recall had very low recall-time. One-third of those with perfect recall had both recall and learning time below the respective medians of the entire group. The two subjects with the highest learning time had imperfect reproduction. Of these the recall time of one was above the median and one below. The two with the highest recall time had the lowest two reproduction times. The variations in the learning and recall times are each dependent upon some factors which the figures fail to show, such as the desire not to seem too slow in both processes; the tendency of some to be over-certain of their having learned the list; and the variations in persistency at trying to recall what at first seems to have been forgotten.

The recall time is especially indefinite as some individuals wrote their total recall at once while others after writing a part of their recall would pause struggling for a word or two. Sometimes there would be a struggle of a minute or more before giving up the task, with no additions. The recall time was computed till the subject wholly gave up the task.

In another study[1] on 84 college and university students the writer found "practically no correlation of time used in recalling the words with accuracy of recall" (coefficient —.09).

Bigham[3] concluded that the longer the interval after learning the longer the time for recall, that the number of errors increased with the time used for recall and that "the quicker the memory is discharged the better is the result." He presented very little evidence in support of these conclusions, however. Myers[2] reported similar observations: "——— that the subjects who used the least time in reproducing the group of letters—remembered the most correct words and added fewer wrong ones; however, there seemed to be no way of indicating satisfactorily the correlation in terms of figures, from the fact that often a few seconds passed before the subject could think of anything."

This problem merits further study.

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[1] Myers, G. C. *A Study in Incidental Memory.* Arch. of Psych. 26: 1913, 65–67.

[2] Ibid, p. 93.

[3] Bigham, J. *Memory.* Psychol. Rev. 1894, 1, 34–38, 453–461.

THE ANCESTORS OF EMINENT MEN[1]

It has been said frequently that each man is the product of his environment. In a measure that is true, but no environment will make a Shakespeare out of an ordinary man. A great man is born, which means that he is the product of a particular kind of breeding. Similarly, a feeble-minded man is born, which also means that he is the product of a particular kind of breeding. The kinds of breeding which produce our great men and our feeble-minded men are as widely separated as are the men themselves. I cannot, in the time at my disposal, go into all of the intricacies by which different kinds of men are produced by breeding, but I can give some of the main essentials, and from these you can obtain a fairly clear understanding of what it is that leads toward improvement, and what it is that leads toward degeneracy.

They tell us that man and the other higher animals have evolved from lower forms of animals by selection, but those who make that statement overlook a very obvious absurdity in their claim. To have selection, parents must have offspring, and to have more selection the offspring must produce another generation, and these in turn another. Each generation gives opportunity for selection, and the more generations the more selection. Anything which would reduce the number of generations in a given period of time would reduce the opportunities for selection to accomplish anything.

At some time on the past there was a common ancestor for man and the higher apes. There have been less generations, and consequently less selection in the line leading from that common ancestor to man, than in the lines leading to the apes. Further back in the past there was a common ancestor for the higher apes and the lower monkeys. There have been less generations, and consequently less selection in the lines leading to the higher apes than in the lines leading to the lower monkeys. Extend that examination to the different species of active animals and you will find that each advance from a lower to a higher stage involved the elimination of selection, and that the actual advance has been inversely proportional to the amount of selection. Carried to its logical conclusion this means that the greatest possible advance will occur when selection is reduced to zero.

They tell us that acquired characters are not inherited, but I am telling you that the persons that make that statement never investi-

[1] Extracts from an address delivered in Chicago, Dec. 10, 1915, before the Eugenics Educational Society.

gated the matter and know nothing whatever about it. They simply repeat what they have been taught, and they cling to the dogma because it agrees with their preconceived ideas. The theory that acquired characters are not inherited originated in a misconception of what an acquired character is, and in an experiment which is absurd on its face.

To acquire means to obtain by effort, by exertion, by the performance of work. An acquired character is one obtained by exercising an organ, or by the work performed by the organ. It consists of a physiological change occurring within the organ which is dynamic in character and is called dynamic development. The amount of an acquirement is proportional to the amount of work performed. A mentally active man has a better developed brain at the age of fifty than he had at the age of twenty, and the difference is due to the extra amount of mental work performed.

If an acquirement is to be inherited, the parent must make the acquirement first and get the offspring afterwards, not get the offspring first and make the acquirement afterwards. Of those who deny the inheritance of acquired characters, what one ever took this into consideration and compared the progeny of parents of different ages on the basis of acquirements? Not one. They have failed to take even the first step in such an investigation whereas they should carry such a one through three or four generations of ancestors.

Among certain eugenists there is a theory that it is impossible to produce an individual which is superior to anything which previously existed. That is, if some very superior individual exists it is because there was, somewhere in his ancestry, a similar superior individual. This theory amounts to a denial of evolution and a return to the Garden of Eden story with Adam and Eve originally created equal to any individual who has since existed.

It is not clear how widely extended this theory is, but it seems to be back of the proposition to sterilize a large part of the population. That proposition is a public confession, by those who make it, that they know absolutely nothing about what causes improvement and what causes degeneracy. In their despair at seeing no way to improve the race other than that of killing off the inferior, they propose the killing process by indirection.

It seems never to have occurred to these gentlemen to write out the pedigree of some remarkable individual for three or four generations and then examine that pedigree for the purpose of learning if

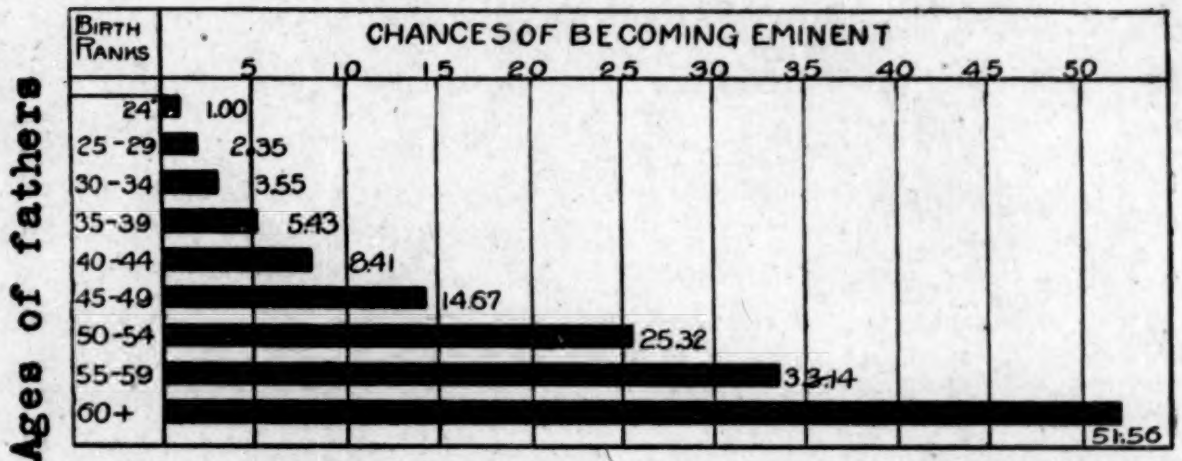
there was anything remarkable about the way he was produced. Wedded to a preconceived theory which they are anxious to support, they make statements without stopping to consider what those statements mean when carried to their logical conclusion.

Let us consider the horse. A century ago there was no horse in the world capable of trotting a mile in three minutes. Now we have horses which have trotted a mile in two minutes. This is an absolute and very great advance in power made in the past 100 years. It has been said repeatedly that this improvement came about through selection, but the statement is not true and is made in complete ignorance of the facts. Selection has been used abundantly among horses, but that selection is not connected with the improvement which has taken place.

High speed at the trot is not a natural gait for horses. It is an artificial gait which never existed in any breed of horses until forced there by the art of man. Less than a century ago the only high speed gait for horses was the run, and when trotters were forced for speed they would break into a run. Now we have "born trotters" which will stick to the trot no matter how hard they are forced, and trotting speed approaches running speed. Here is a new character in the trotters of today.

To have selection a mare must have several foals. If she produces but one foal in her entire life, there can be no selection in her line. It is take that foal or none. Write out the pedigree of any 2:10 trotter, it matters not what one, and extend that pedigree to the time when there was no such thing in the world as a 2:30 trotter. In that pedigree there will be from 5 to 20 mares, no one of which ever had more than one foal in her life. The other mares, and the sires in the pedigrees, will be found, on investigation, to have produced less than the normal number of foals. Also, the lines of improvement to our high speed trotters average only 7 generations to the century, while the normal number is 10 generations. Actual improvement came in those lines in which opportunity for selection was reduced to its lowest limit.

The same thing is true in intellectual power in man. Take any list of intellectually eminent men and you will find that they were sons of men much older than the average age of fathers when sons are born. A few will be found to be sons of comparatively young fathers, but push the investigation in those cases a little further and you will find that while it is possible to get an eminent man from a



Relative chances of becoming eminent, as measured by age of father at birth of son. From "Great Men," by Redfield.

young father it is impossible to get one from a succession of young parents. A succession of young parents always results in the production of mental inferiority, and, if the parents are unusually young, in such a succession the product is weak mentality.

To maintain any group of animals on a level in its power capabilities there must be a certain amount of acquirement per generation before reproduction. If the amount of acquirement is decreased there is a decline in power capabilities toward a lower corresponding level. If the acquirement is increased there is a rise toward a higher corresponding level. The age of parents at time of reproducing is one factor in measuring the amount of acquirement, and an investigation which did not consider this factor in at least three generations of ancestors would be superficial.

CASPER L. REDFIELD.

Chicago, Ill.

BINET AND PORTEUS TESTS COMPARED. EXAMINATION OF ONE HUNDRED SCHOOL CHILDREN

The aim of this investigation was to compare the results obtained by examining normal school children by the Binet and by the Porteus series of tests. These latter were intended primarily to serve as an aid in the diagnosis of mental deficiency and are directed towards the testing of capacities in which the feeble-minded appear to be specially lacking. But it becomes evident to those who use them that this does not necessarily define the limits of their usefulness. Interesting results were expected from their application to normal children, especially when those results could be checked by the parallel use of the Binet scale. Their comparison is rendered easy because the Porteus tests are graded by years of chronological age.

The form of the Binet used was the latest revision by Dr. Goddard of America. The Porteus Tests were the same as those published in the Journal of Psycho-Asthenics for June, 1915, though a later method of scoring was adopted. This alteration consists in counting up the number of tests in which the child required the full number of trials allowed, in order to pass—two trials are allowed for Test 6 to 11 years, three trials for Test 12 to 13 years—and then making certain deductions from the highest test passed, in order to arrive at the mental age. If the full number of trials was required in two tests, one year is deducted, if in three tests 1½ years are deducted, and if in four tests, 2 years; *e. g.*, A passes the 9 year test (2 trials), the 10 year test (2 trials), the 11 year test (2 trials), and then fails in the 12 and 13 year tests. Mental age equal 11 years (highest age passed) minus 1½ years = 9½ years. The child who "scrapes through" is thus penalized.

The children were selected for examination by the head teacher of the school, Miss Fleming, to whom I am much indebted for assistance and for permission to carry out the examination.

Table I shows the individual records. Column 4 shows the differences between the two mental age estimates by the two series.

Table II is a summary of Table I.

The children are placed higher by the Porteus Test than the Binet in 64 cases, lower in 36 cases. In 78 instances both series agree in classifying the children as being "at, above, or below age" mentally. In the remaining 22 cases they differ, though in 7 of these there is only a half year difference between the two estimates. They are, therefore, in practical agreement in 84% of the cases.

TABLE I

Individual Records

Case No.	Binet	Porteus	Difference	Age	Case No.	Binet	Porteus	Difference	Age	Case No.	Binet	Porteus	Difference	Age
1	5½	5	—½	4½	35	8	7	—1	8½	68	10	10	0	9
2	6	6	0	7½	36	8	8	0	10	69	10	11	1	10
3	6	6	0	4½	37	8	8	—0	8	70	10	11	1	11
4	6	6	0	5	38	8	8	0	9	71	10	10	0	12
5	6	7	1	5½	39	8	8	0	5½	72	10	11	1	8
6	6	5	—1	4½	40	8	9	+1	6	73	10	11	1	9½
7	6	6	0	5	41	8	5½	—2½	7	74	10	10½	½	9½
8	6½	8	1½	7½	42	8	8	0	7	75	10	13	+3	9
9	6½	7	½	7	43	8½	7	—1½	11	76	10	12	2	9
10	6½	7	½	5½	44	8½	7	—1½	6½	77	10½	12	1½	8½
11	6½	5	—1½	5½	45	8½	7	—1½	6½	78	10½	11	½	9½
12	6½	6	—½	5½	46	9	10	1	11	79	10½	7	—3½	8½
13	6½	7	+½	5½	47	9	7	—2	12	80	10½	12	+1½	8½
14	6½	6	—½	5	48	9	10	1	11	81	10½	8	—2½	7½
15	6½	6½	0	5	49	9	9	0	11	82	10½	8	—2½	10
16	6½	6	—½	6	50	9	9	0	10	83	10½	11	½	11½
17	7	7	0	6	51	9	8	—1	6½	84	10½	11	½	10
18	7	8	1	9	52	9	9	0	9½	85	10½	11	½	9½
19	7	10½	3½	8	53	9	10	1	7	86	11	11	0	9½
20	7	5	—2	6	54	9	10	1	7½	87	11	12	1	9½
21	7	6	—1	6	55	9	8	—1	7	88	11	9	—2	13½
22	7	6	—1	5½	56	9	13	+4	10½	89	11	11	0	11
23	7	7	0	5½	57	9	7½	—1½	7½	90	11	12	1	13
24	7	7	0	5½	58	9	8½	—½	8	91	11	10½	—2	11
25	7	7	0	6	59	9	8	—1	7	92	11	11	0	10
26	7	7	0	6½	60	9	11	2	7	93	11	10½	—½	10½
27	7	8	1	6½	61	9	8½	—½	6½	94	11	12	1	14
28	7½	7	—½	5½	62	9½	9	—½	9	95	11	10	—1	11
29	7½	7	—½	9	63	9½	8	—1½	13	96	11½	13	1½	11
30	7½	5½	—2	6½	64	9½	9	—½	7½	97	11½	13	1½	12
31	7½	8	½	6½	65	9½	10	½	8½	98	11½	11	—½	13
32	7½	8	½	6	66	9½	10	½	10	99	11½	12	½	11½
33	8	9	1	7	67	9½	9	—½	6	100	12	13	1	11½
34	8	8	0	7										

TABLE II.

Summary of Differences

Binet and Porteus Results

No difference	24 cases	
½ year	27 cases	
1 year	25 cases	
		76
1½ years	11 cases	
2 years	6 cases	
2½ years	3 cases	
3 years	1 cases	
3½ years	2	
4 years	1 cases	
	—	24
	100	

NOTE—In reckoning the ages of the children, 1, 2, and 3 months were disregarded; 4, 5, 6, 7, and 8 months were reckoned half a year, while for 9, 10, and 11 months a year was added to the age in years.

The coefficient of correlation by the Pearson formula works out at r = .707. Taking into account the different nature of the series, this correlation may be considered high.

In cases where there is wide difference in the estimate by the two series, the teacher's reports as to the attainments of the children are of special interest. A few of these are appended.

Case No. 47. Age 12 years. Binet 9, Porteus 7 (6 year—2 trials, 7 year passed—1 trial). Teacher: "Defective palate. Postnasal growth. Defective speech. Suffers from severe headaches. Probably feeble-minded."

Case No. 79. Age 8½. Binet 10½, Porteus 7 (7 year—2 trial, 8 year failed, 9 year—2 trials). Teacher: "Bright. Highly imaginative. Good memory. Good in all subjects except drawing, writing and modelling. Inclined to bully, untidy and impulsive."

Case No. 63. Age 13. Binet 9½, Porteus 8 (8 year—1st trial, 9 and 10 failed). Teacher: "Indifferent. Shows no enthusiasm in her work. Reasoning power weak. Backward. Has attended a number of schools." Examiner's Note: "Unable to sustain attention except for very short periods. 60 words test (free association) 1st minute 30, 2d minute 10, 3d minute 8."

Case No. 88. Age 13½. Binet 11, Porteus 9. Teacher: "In hospital two years for eye troubles. Probably mentally defective.

Case No. 43. Age 11. Binet 8½, Porteus 7. Teacher: "Dull, no initiative. Finds it difficult to express thoughts on any subject. (Five in family, all probably defective.)"

Case No. 82. Age 10. Binet 10½, Porteus 8. Teacher: "Dull, reasoning power weak. Diffidence in expressing thoughts. Attends school regularly, is attentive but makes very little progress."

Case No. 8. Age 7½. Binet 6½, Porteus 8 (8 year—2 trials, 9 year—2 trials). Teacher: "Dull, slow in answering. Language, number and reasoning weak. Not interested in work or play. Two in family mentally defective." Examiner's Note: "Very nervous, reluctant to talk."

Case No. 56. Age 10½. Binet 9, Porteus 13 (10 year—2 trials). Teacher: "Bright. Good in arithmetic, geography. Language work weak. Impulsive. Subject to fits of bad temper. Defective palate."

Case No. 19. Age 8. Binet 7, Porteus 10½ (8 year—2 trials, 10 year—2 trials, 12 year—3 trial). Teacher: "Dull. Mind in number work blank. Quiet, unresponsive. Does not mix with

children in playground." Examiner: "Painstaking, cautious, inclined to be slow and hesitating. Number work and comprehension poor."

Case No. 75. Age 9. Binet 10, Porteus 13 (12 year—3 trials). Teacher: "Very bright. Good command of language. Visualizes well. Reasoning power and memory very good. Enthusiastic. Likes to lead."

Case No. 81. Age 7½. Binet 10½, Porteus 8 (8 year 2 trials, 9 year—2). Teacher: "Very brief. Good reasoning powers. Observant, studious. Good in all subjects. Ambitious and always interested in work."

Case No. 41. Age 7. Binet 8, Porteus 5½. Examiner's Note: "Very bright. Talks freely and intelligently. Very well developed on ideational side."

The above reports were furnished by the head teacher without knowledge of the result of the test. It will be seen how her reports frequently emphasize a view of the child's intelligence which one or other of the series of tests has failed to bring out, showing the necessity for supplementing one series by the other. The tendency of the Porteus tests appears to be to accentuate individual differences by marking the dull children lower, and the bright children higher than does the Binet.

In criticising the Porteus tests it should be borne in mind that they are not intended to be used alone, but are to be regarded as a very useful adjunct to the Binet scale. The capacities called into operation by these former tests appear to be principally forethought and prudence, ability to sustain attention, to improve with practice, and to resist misleading suggestions. No doubt the possession of these qualities is essential to the development of a moral sense and this fact probably accounts for the very poor showing that criminals make in these tests. The connection with general intelligence is not so easily worked. Yet the one who learns most rapidly from experiences is probably the person who goes slowly and surely, refusing to act blindly or impetuously, and who uses observation and discrimination. In so far as the Porteus tests enable us to try these capacities we can make a forecast of the probabilities of future development. It is quite possible for a child to succeed in these tests and yet be deficient in certain definite though limited directions, e. g., in number sense. But in general the capacities which make for success are

so important that the child possessing them is almost certain to be capable of training and improvement along important lines.

Some other points may be briefly summed up.

1. The Porteus Test requires but little time to apply—from ten to fifteen minutes is sufficient.

2. Results are not directly affected by previous school training.

3. Interest is aroused in the child by the puzzle element.

4. The response required being motor, not verbal, is a distinct advantage, when dealing with certain children such as deaf and dumb.

5. Success or failure in individual tests may be easily decided if instructions are adhered to strictly.

6. The tests provide the child with a situation wherein his reaction may be closely observed. Certain moral questions in the Binet are merely verbal problems. A significant commentary on such problems may be drawn from one of Binet's own questions, "Why do we judge of a person more by his acts than his words?"

7. The Porteus Tests require minor alterations and they undoubtedly may be graded more correctly according to the various mental ages. They are at present, easier, on the whole, than the Binet, when considered as general intelligence tests. It is worth while reiterating that they must be regarded as supplementary tests only. When we wish to measure the attainments of a child the mental map provided by the Binet is the more helpful. But if we wish to obtain a further insight into the child's nature and to estimate the importance of the relation between temperament and intelligence then the Porteus test can be recommended.

There must, however, be close observation of the child whilst he is performing the best trials. There is no statistical method of evaluating the various factors that make for success and the final result gives us merely a summary of operations.

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THE

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EDITORIAL

THE NEW PHYSIOLOGY

The history of any science reveals a curious pendular movement of human thought in its efforts to grasp and systematize the complex phenomena of nature. In a masterly paper on "The New Physiology" in a recent number of *Science* the eminent English physiologist, Dr. J. S. Haldane, gives an illuminating account of the present trend in that field. Until the middle of last century "it was generally held that in a living organism a specific influence, the so-called 'vital force,' controls the more intimate and important physiological processes. Inspired by the rapid advances of physics and chemistry, the younger physiologists of that time broke away from vitalism, and maintained that all physiological change is subject to the same physical and chemical laws as in the inorganic world, so that in ultimate analysis biology is only a branch of physics and chemistry. The subsequent progress of physiology has shown that all, without exception, of the physical and chemical hypotheses then advanced in explanation of intimate physiological processes were far too simple to explain the facts; but the general conclusion that biology is only a special application of ordinary physics and chemistry became firmly established, and is

still what may be called the orthodox creed of physiologists." The present swing of the pendulum is back, not to vitalism indeed, but to a system of inter-connected normals" so delicate in its balance and so marvelously responsive to slight changes in the environment that threaten to destroy this balance as to be quite beyond the possibility of explanation on the old mechanistic basis. "Each phenomenon of life, whether manifested in 'structure' or in 'environment' or in 'activity,' is a function of its relation to all the other phenomena, the relation being more immediate to some, and less to others. Life is a whole which determines its parts. They exist only as parts of the whole."

A similar swinging of the pendulum can be detected in psychology. Until the middle of the eighteenth century faculty psychology reigned supreme. Then came the English associationist school with its analysis of mental life into atomic sensations mechanically held together by mysterious bonds of association. This reached its climax in the work of the early psychological laboratories, and provoked the reaction of "functional psychology,"—a point of view which, according to Wundt, comes perilously near being a relapse into faculty psychology. There is little doubt that many of the explanatory terms of recent psychology are too formal and schematic. One need only cite the abuse of the term "instinct," which owes its vogue in American psychology chiefly to James, and upon which two of the most widely used books in educational psychology are constructed. Even so good a psychologist as Woodworth speaks in a recent lecture of "instincts and their importance throughout life as driving forces." Great credit is due to Thorndike for subjecting many of the so-called instincts to critical analysis and showing how little basis there exists for such sweeping terms as the instinct of play, the instinct of imitation, or the instinct of curiosity. The examination of specific instances of these activities shows that we have to do with the functioning of an inherited organism more or less highly modified by experience. In no case must the experiential factor be overlooked. Thus the so-called instincts are in principle not a whit different from playing the piano, writing good English, or mastering geometry. The difference is only one of degree. As in physiology so in educational psychology the present trend is away from explanations in mechanistic or mystical terms toward correlations of activities and the discovery of the "inter-related normals" on which the learning process depends.

J. C. B.

NOTES AND NEWS

The sixty-ninth meeting of the American Association for the Advancement of Science will be held in New York City December 26–30. This is the first of the greater convocation-week meetings which are hereafter to be held once every four years in the large centers of population, as New York, Chicago, Washington, etc. A record attendance is expected, and is it prophesied that this will be the greatest meeting of scientific men ever held in this country or elsewhere. The meetings of Section L (Education) promise to be of particular interest. The main topic will be "Educational Measurements," and over fifty papers have been received describing experimental studies of pupils' attainments, methods of teaching, supervision, and use of the school plant. In affiliation with this meeting will be held the twenty-fifth annual meeting of the American Psychological Association, December 27–30, at Teachers College, Columbia University. The address of the president, Professor Raymond Dodge, will be on "The Laws of Relative Fatigue," and on Friday afternoon the twenty-fifth anniversary of the founding of the association will be celebrated in a series of papers by G. Stanley Hall, J. McKeen Cattell, Joseph Jastrow and John Dewey.

The New York Branch of the American Psychological Association held its first meeting for the academic year on Monday evening, November 27, at Columbia University. The following papers were read: "Echolalia in Idiots: Its Meaning for Modern Theories of Imitation," by L. S. Hollingworth; "The Shrinking of Images," by G. C. Myers; "A Comparison of the Binet-Simon Tests of Intelligence and the Squire Graded Mental Tests," by J. C. Bell.

On Saturday, October 28, a "Conference on Aspects of Psychological Examination" was held at the Massachusetts School for Feeble-Minded, Waverley, Massachusetts. The following papers were presented: "Present Status of Methods for Measuring Intellectual and Affective Reactions," by R. M. Yerkes; "Brain Complexity in Relation to the Results of Psychological Examinations," by E. E. Southard; "Methods of Detecting and Measuring Mental Deterioration," by S. L. Pressey; "A Point Scale for the Measurement of Intelligence in Adolescent and Adult Individuals," by C. S. Rossy; "The Weighing of Point Scale Tests: A Criticism of the Original Point Scale and Suggested Improvements," by Rose S. Hardwick; "Criteria

for the Proper Evaluation of Tests and Test Series," by Florence Mateer; "The Significance of Point Scale Coefficients of Intelligence," by Louise Wood; "Comparison of Point Scale and Binet Measurements of Mental Defectives in the School for Feeble-Minded at Waverley," by Josephine M. Curtis; "Studies of Intellectual Defectives and Cases of Dementia Praecox by the Multiple Choice Method," by C. S. Rossy; "The Standardization of Supplementary Psychological Methods at the Psychopathic Hospital," by Marjorie H. Rossy; "A Method of Measuring Ideational Efficiency," by R. M. Yerkes.

At the Voice Clinic, Psychopathic Department, Boston State Hospital, under the leadership of Dr. Walter B. Swift, five series of papers have been presented on the general topic of "Universal Mental Measurement." The first series, on October 22, 1915, dealt with "The Philosophy of Mental Measurement"; the second, on February 25, 1916, "The New Basis of Mental Measurement"; the third, on October 6, 1916, "Critique of Tests"; the fourth, on November 3, 1916, "Finer Mentation that may be Tested"; and the fifth, on November 27, 1916, "Technique for the Medical System of Mental Tests." On December 15 Dr. Swift will discuss "A New Philosophy of Life based upon Developmental Psychology."

A "New York Committee on Feeble-Mindedness" has been organized with the following objects: Early care, training and supervision of all mental defectives in the state; measures and methods for preventing a future increase in the number of the subnormal; establishment of special classes in the public schools; establishment of a system of guardianship and supervision in the home to supplement institutional and farm colony care; double the number of places for the feeble-minded and epileptic in New York state institutions. The executive secretary is James P. Heaton, United Charities Building, New York City.—*School and Society.*

Dr. Alexander Johnson, for thirteen years secretary of the National Conference of Charities and Correction, has been selected as the expert for the Colorado State Survey Commission to investigate and make recommendations concerning the care of mental defectives and insane in the state, and the charities and corrections departments of the state.—*Science.*

The orthopedic department of the Children's Hospital, Boston, will offer a course, beginning on December 1, 1916, in muscle training and in the principles of the nursing aftercare of infantile paralysis.—*Science.*

PUBLICATIONS RECEIVED

MAURICE A. BIGELOW. *Sex Education. A Series of Lectures Concerning Knowledge of Sex in its Relation to Human Life.* New York: The Macmillan Company, 1916. Pp. xi, 251. $1.25.

This excellent discussion of various phases of sex education from the pen of one of the leaders in biological study will be cordially welcomed by those who are confronted by the problems of sex in the education of boys and girls. The author agrees with those who claim that sex instruction should be given in the home, but he also recognizes the fact that few parents are able and willing to carry this instruction to the point where it will be really helpful in controlling conduct. It is therefore necessary to go beyond the home and to include a consideration of the fundamental facts of sex in the work of the schools. Chapter two presents clearly and succinctly eight problems for sex education, and the remainder of the book is devoted largely to the solution of these problems. The writer recognizes the danger of suddenly thrusting sex education into the course of study by legislative enactment and believes the greatest of care should be exercised in the choice of teachers. In some cases sex instruction may be profitably given in biology classes containing both boys and girls, but in general a better attitude can be secured by teaching boys and girls in separate classes with teachers of the same sex. There is a consideration of the phases of sex instruction to be emphasized in the pre-adolescent years, in early adolescence, and in late adolescence. A selected bibliography of eight pages is included.

EDWIN F. BOWERS. *Alcohol—Its Influence on Mind and Body.* New York: Edward J. Clode, 1916. Pp. ix, 207. $1.25.

The author of this book arrays the opinions and findings of physicians, physiologists, statisticians, and managers of industry in an appeal to the average man to realize the evils of the drink habit and the sale of alcoholics. It could scarcely be called an unbiased scientific discussion, but is rather a vigorous brief for the cause of abstinence.

GEORGE VAN NESS DEARBORN. *Notes on Affective Physiology.* Reprinted from the Medical Record, April 8, 1916. Pp. 63.

A valuable survey of recent experimental and theoretical work on emotional reactions, with a bibliography of forty-six numbers. The author believes that the traditional division of emotional benavior into eighty or more feelings or emotions will be soon abandoned for a simpler classification on the basis of the complex oppositions which biologically underly all of these shades of feeling. The chief of these oppositions is that between impulse and personal control.

GEORGE VAN NESS DEARBORN. *Movement, Cenesthenia, and the Mind.* Reprinted from the Psychological Review, Vol. 23, May, 1916, 190–207.

The author pleads for a broader and more basic conception of psychology than that which is characteristic of most of our research laboratories. The factors of movement and of adjustments to situations have been too much ignored. In general the article leans to the behavioristic point of view, and the claim is made that psychology is perfectly well-fitted to be a popular and essential grammar school subject.

JOHN DEWEY. *Essays in Experimental Logic.* Chicago: University of Chicago Press, 1916. Pp. vii, 444. $1.75.

In 1903 the author published a volume entitled *Studies in Logical Theory*, containing essays by himself and his pupils. The edition of the *Studies* has been exhausted, and in the present volume the author has reissued those portions of the previous work which he himself wrote, and has added a number of essays of similar nature. The chapters deal with such topics as the relationship of thought and its subject matter, the antecedents and stimuli of thinking, data and meanings, the object of thought, the logical character of ideas, control of ideas by facts, naive realism versus presentative realism, the existence of the world as a logical problem, what pragmatism means by practical, and the logic of judgments of practice.

E. A. DOLL. *Note on the "Intelligence Quotient."* Reprinted from the Training School Bulletin, April, 1916.

The author proposes a scheme of classification of children, from the feeble-minded through the normal to the talented, on the basis of the "intelligence quotient."

E. A. DOLL. *Preliminary Note on the Diagnosis of Potential Feeble-mindedness.* Reprinted from the Training School Bulletin, May, 1916.

A systematic consideration of the lines of investigation that need to be followed up in arriving at a conclusion as to whether a child will probably be feeble-minded or not.

KNIGHT DUNLAP. *The Results of a Questionary on Psychological Terminology.* Johns Hopkins University Circular, Whole No. 285, May, 1916, No. 5. Pp. 55.

Eleven questions regarding the use of such terms as experience, consciousness, thought, and sensation were sent to the senior members of the American Psychological Association. The monograph presents a detailed tabulation of the replies. The author concludes that the term "experience" seems hopeless of standardization and should be

abandoned as a scientific term. The term "consciousness" has lost many of its metaphysical meanings and there is a tendency to use it to indicate awareness in general.

GEORGE OSCAR FERGUSON, JR. *The Psychology of the Negro. An Experimental Study.* Archives of Psychology, No. 30, April, 1916. Pp. 138. $1.25.

This monograph reports the results of extensive comparative tests of negroes and white children in the schools of Richmond, Fredericksburg, and Newport News, Virginia. The following tests were used: mixed relations, completion, maze, and cancellation. Twenty-five pages are devoted to a review of work previously done, and the last fifty pages deal with classifications of negroes and the conclusions that may be drawn from the study. The detailed scores of the results of the tests will be of value for comparison with other school children. The author concludes that the average performance of the colored population of the country is only about three-fourths as efficient as the performance of whites with the same amount of training.

DOROTHY CANFIELD FISHER. *Self-Reliance.* Indianapolis: The Bobbs-Merrill Company, 1916. Pp. 243. $1.00.

In this book the author takes up in easy conversational style some fundamental problems in education. In a certain sense the book might be characterized as an application of the Montessori principles to child life in the home and in the school. The educative value of self-help even in early childhood, and the manifold ways in which adults thoughtlessly interfere with the child's self-education are illustrated by numerous anecdotes. Later the Robinson Crusoe impulse manifests itself, and should be thoughtfully fostered by parents and teachers. The author has a rather scathing denunciation of the herding of pupils in schools, and foresees dire consequences from the suppression of individuality and initiative entailed by these conditions.

ABRAHAM FLEXNER AND FRANK P. BACHMAN. *Public Education in Maryland.* Second Edition. New York: General Education Board, 1916. Pp. xviii, 230.

The second edition of this report contains an appendix of 54 pages embodying the new education laws of the state of Maryland adopted at the last session of the legislature.

FRANK N. FREEMAN. *Experimental Education. Laboratory Manual and Typical Results.* Boston: Houghton, Mifflin Company, 1916. ix, 220. $1.30.

There is a growing consciousness among teachers of educational psychology and education that the ordinary laboratory manuals of psychology are quite inadequate for the training of students in edu-

cation. The first departure was Starch's laboratory manual of educational psychology, which did not get very far from the traditional type of laboratory exercise. A laboratory manual more intimately connected with the subject matter of education courses has been greatly needed. Moreover during the past ten years the experimental material available for such a manual has grown at a rapid rate. It is with the object of systematizing this material and making it available for laboratory purposes that the present book was written. In his introduction the author points out that the earlier work in educational psychology was conducted by professional psychologists with the aim of making an application of general psychological principles to education. The procedure of this book is precisely the opposite: "It attacks directly the practical problems and attempts to throw light upon them by an analysis of the psychological principles which are involved in them." Sixteen experiments are presented, arranged in three groups. Group one is concerned with an analysis of various types of the learning process. It includes a modified mirror reaction experiment; perceptual learning, involving the reproduction of a complex figure; puzzle solving; transfer of training and mirror reactions; rote memorizing; and memory for sense material. Group two consists of experiments in school subjects, including an experimental analysis of hand writing, the measurement of handwriting, observation of eye movements in reading, techistoscopic studies of reading, the measurement of efficiency of reading, and the application of number. Group three is devoted to tests, and there are directions for testing visual acuity, auditory acuity, immediate memory for numbers, the reconstruction of sentences, and correlations between the tapping test, pitch discrimination, and the opposites test. Each chapter is followed by a set of questions and topics for discussion and a few selected references. The book is a noteworthy advance over any laboratory manual at present available for classes in education.

SIDONIE MATZNER GRUENBERG. *Sons and Daughters.* New York: Henry Holt and Company, 1916. Pp. vi, 328. $1.40.

A series of non-technical talks on fundamental factors in education. Some of the titles are Modern Parenthood, The Physical Basis of Development, Individual Differences, The Changes of Adolescence, Types of Difficult Children, Pugnacity, Character as Habit Formation, The Management of Children, The Child and Society. The book is composed largely of illustrative anecdotes.

THOMAS H. HAINES. *A Mental Survey of the Ohio State School for the Blind.* The Ohio Board of Administration, Publication No. 9, January, 1916. Pp. 24.

There is a detailed study of age distribution, an evaluation of intelligence by means of the Yerkes Point Scale, a comparison of blind with seeing children, and a description of eight cases of feeble-

mindedness. Twenty-one persons were found to be so definitely feeble-minded that they were unable to profit from the work of the school.

DAVID SPENCE HILL. *Industry and Education. A Preliminary Study of Manufacturing Establishments in New Orleans and Mechanical Occupations of Boys and Men with Reference to Education, and a Plan for the Delgado School.* New Orleans: The Commission Council, June, 1915. Pp. xiii, 409.

The present report embodies the results of one of the most detailed and systematic surveys of the industries of a community from the point of view of school work that has yet been published. Among the industries studied were the mental working industries, power, light, and heating plants, electrical manufacturing and construction, including telephone and telegraph systems, lumber and its manufactured products, the building trades, printing and publishing, nautical employments, sea-food industries, and scientific agriculture. In each of these industries the attempt was made to determine exactly the amount and quality of labor demanded, and the measures that the school might take for preparing pupils to better meet the demand.

GEORGE BURTON HOTCHKISS AND CELIA ANNE DREW. *Business English, Its Principles and Practice.* Cincinnati: The American Book Company, 1916. Pp. viii, 376.

This is an attempt to adapt the English work of the schools to the demands of business life. Part one deals with the essentials of business English; part two with business forms and usages, including business, official, and social letter writing; part three with the details of business correspondence, and part four with sales letters and advertising. Aside from the training in English the book contains much information on the conduct of modern business.

CHARLES HUBBARD JUDD AND SAMUEL CHESTER PARKER. *Problems Involved in Standardizing State Normal Schools.* Bulletin 1916, No. 12, Washington: Bureau of Education, 1916. Pp. 141. 15c.

The bulletin contains a comparison of colleges and normal schools, a study of the services rendered by normal schools in typical states, their administrative control, facilities for practice teaching, size and equipment of faculties, and the training offered by the courses of study. The final chapter considers a plan for developing normal school standards.

TRUMAN LEE KELLEY. *Tables to Facilitate the Calculation of Partial Coefficients of Correlation and Regression Equations.* Bulletin of the University of Texas, 1916, No. 27, May, 1916. Pp. 53.

These tables are constructed to reduce the labor involved in the calculation of partial coefficients and regression equations. In his introduction to the tables Professor E. L. Thorndike says, "Twenty years ago the ordinary coefficient of correlation for one series of

paired values was a recondite mathematical technique just beginning to be used by a few biometricians. Now it is a stock means of measuring resemblance or correspondence employed when appropriate by all competent investigators. The same career might be prophesied for partial coefficients of correlation but for the complexity and tediousness of the computations involved. It is the service of Dr. Kelley's tables to reduce these." In a few pages the author develops the theory of partial coefficients and regression equations and gives an outline for the calculation of regression coefficients. The tables themselves occupy approximately 30 pages.

MARY STORER KOSTIR. *The Family of Sam Sixty.* Columbus: The Ohio Board of Administration. Publication No. 8, January, 1916. Pp. 29.

This is an interesting study of a family embracing 474 representatives, on 261 of whom some data has been secured. There are detailed descriptions of individuals and seven geneological charts. The study is similar to Goddard's *Kallikak Family*, and is of great interest to criminologists and students of heredity.

WILLIAM D. LEWIS AND JAMES FLEMING HOSIC. *Practical English for High Schools.* Cincinnati: The American Book Company, 1916. Pp. 415.

The authors have set for themselves the following principles in the construction of this book. One, a textbook should be primarily a laboratory guide; two, the pupils should learn not a theory but a method of work; three, practice in expression has little value unless it grows out of a real situation; four, both good speech and good writing are matters of habit; five, much of the material in the books now used is over-mature, ambitious, and unrelated to the thoughts of young people; six, great stress should be laid on social and business letters, newspapers, and magazines; seven, the best teaching requires a real social situation in the classroom. It will be interesting to see whether these two well-known radicals in education have been able to produce a practical textbook in high school English.

JASPER L. MCBRIEN. *America First. Patriotic Readings.* Cincinnati: American Book Company, 1916. Pp. 288.

A collection of readings from various sources adapted to patriotic occasions.

HERBERT ADOLPHUS MILLER. *The School and the Immigrant.* Cleveland: The Cleveland Education Survey, 1916. Pp. 102. 25c.

The author presents a statistical study of children from non-English speaking homes, details the efforts of the national groups to preserve their languages, discusses the characteristics of the national groups and considers the problem of education for these children. The work that should receive the greatest emphasis with these children is a mastery of speaking, reading, and writing the English language.